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The Outlook

The Helicopter Picture

ATTENTION is drawn by the details of the Kaman K-190 published in this issue to the seemingly infinite variety of solutions which ingenious designers scheme out in attempting to solve the many problems associated with the helicopter. And still there is no finality in sight, nor likely to be for several years to come. This is scarcely surprising in view of the large number of variables that are possible.

The basic general configurations are, however, beginning to emerge, and a broad classification divides them into three groups, within each of which there is ample scope for originality. They are: single, twin and triple rotor conceptions, and each is capable of more than one interpretation.

In the single-rotor class, which Igor Sikorsky has made classic, it is necessary to provide some means of counteracting the torque reaction from the main rotor by a smaller, non-lifting airscrew. This can be mounted at the tail to give lateral thrust, as in the Sikorsky and Bristol helicopters and many others; or it can be mounted on a wing stub to give forward propulsion, as in the Fairey Gyrodyne.

Two main rotors can be arranged in a number of ways. They can be mounted coaxially one above the other, and driven in opposite directions to cancel out torque. This arrangement has not been used in very many helicopters and may disappear altogether.

There are three other ways of arranging two rotors: in tandem, as in the Piasecki; side by side, as in the large McDonnell and small Landgraf; and side by side but intermeshing, as in the Kellett and Kaman.

So far the only three-rotor helicopter is the Cierva Air Horse, W 11, now nearing completion at Southampton. This will be by far the largest helicopter ever built, and the three-rotor arrangement in the form of a triangle should give stability as well as manœuvrability.

When it comes to the rotors themselves, the variety of ideas is such that segregation into groups is almost impossible, although classification according to the number of blades shows two, three and four in actual use. Hitherto, the single-bladed rotor has not found much favour, and the use of more than four blades leads to a very complicated hub mechanism.

The Source of the Headaches

THE greatest divergence of opinion among helicopter designers is found in the choice of blade control and rotor-head mechanism. They range from the simple L-section steel-plate attachment of the Seibel to forms which were once described by Lord Weir as monuments to mechanical engineering! Two main control systems are in use: the tilting head and cyclic pitch control. The former was introduced in the Autogiros by the late de la Cierva, and Dr. Bennett has remained faithful to it in the Fairey Gyrodyne. Cyclic pitch control is, however, employed in far and away the greatest number of helicopters.

There are, of course, a great many ways in which cyclic pitch control can be arranged. Usually it demands a bearing at the blade root, although in the Bristol Mr. Hafner uses a torsionally flexible tie rod. In the Kaman K-190 the actual blade material (solid wood) is twisted to give the change in blade angle, the operation being controlled by a servo flap behind the blade.

The so-called flapping hinge, another Cierva idea, does, of course, provide an aerodynamic pitch change in that the rising blade has its virtual angle of incidence decreased while the falling blade has it increased, but an additional control is still required for manœuvring.

Finally, there is the rigid rotor, in which the blades have neither flapping nor drag hinges. This type is best exemplified by the little Landgraf, in which the two three-bladed rotors are arranged side by side, being

carried at the extreme tips of wing stubs, which also house the tie-rod transmission.

The rigid rotor was used by Cierva in one of his first Autogiros, but as this was a single-rotor type, the lateral tilt caused by the unsymmetrical lift distribution led to its being abandoned in favour of a rotor with flapping hinges. In the Landgraf, developments of which are being built in this country by Firth Helicopters, there is, strictly speaking, no change of pitch, the equivalent of this taking the form of a change of blade camber through controlled trailing-edge flaps.

The mechanical simplicity of the Landgraf arrangement is very attractive, and the success of its application to larger helicopters would appear to be mainly dependent upon the adequacy of the camber-changing device for smoothing-out vibrations and roughness.

From the amount of brains, energy and money being expended on development, it is reasonable to expect the emergence, in a few years, of several practical and not too expensive helicopters. Already this class of aircraft is doing good work, and the number of its useful applications is almost unlimited. At present we have only scratched the surface.

The New Generation

DISAPPOINTMENT will be felt by many British and foreign visitors to the S.B.A.C. Display at Farnborough next month at the absence of the Armstrong-Whitworth Apollo. This machine, fully described this week, will be a very attractive aircraft for service in many parts of the world, and may be expected to become a good contributor to the British export market. At one time it was hoped to have the Apollo ready in time for Farnborough, but, unfortunately, this is not likely to be possible.

The A.W.55 incorporates many features which should make for the safety and comfort of its occupants. At the same time, its general design follows well-tried practice so that the teething troubles which beset every new aircraft should not be serious, nor of long duration.

Apart from its general appeal as a modern turboprop aircraft, the Apollo promises to score on account of the possibility of fitting it with alternative power plants. Turboprops may not necessarily be the first choice of all potential users, and particulars have been issued of weights and performances applicable to three types of engine: the Armstrong Siddeley Mamba turboprop, the Pratt and Whitney Twin-Wasp, and the Rolls-Royce Merlin 35. The Mamba installation is the lightest and thus gives the greatest disposable load, but really attractive figures are also attained with the other two.

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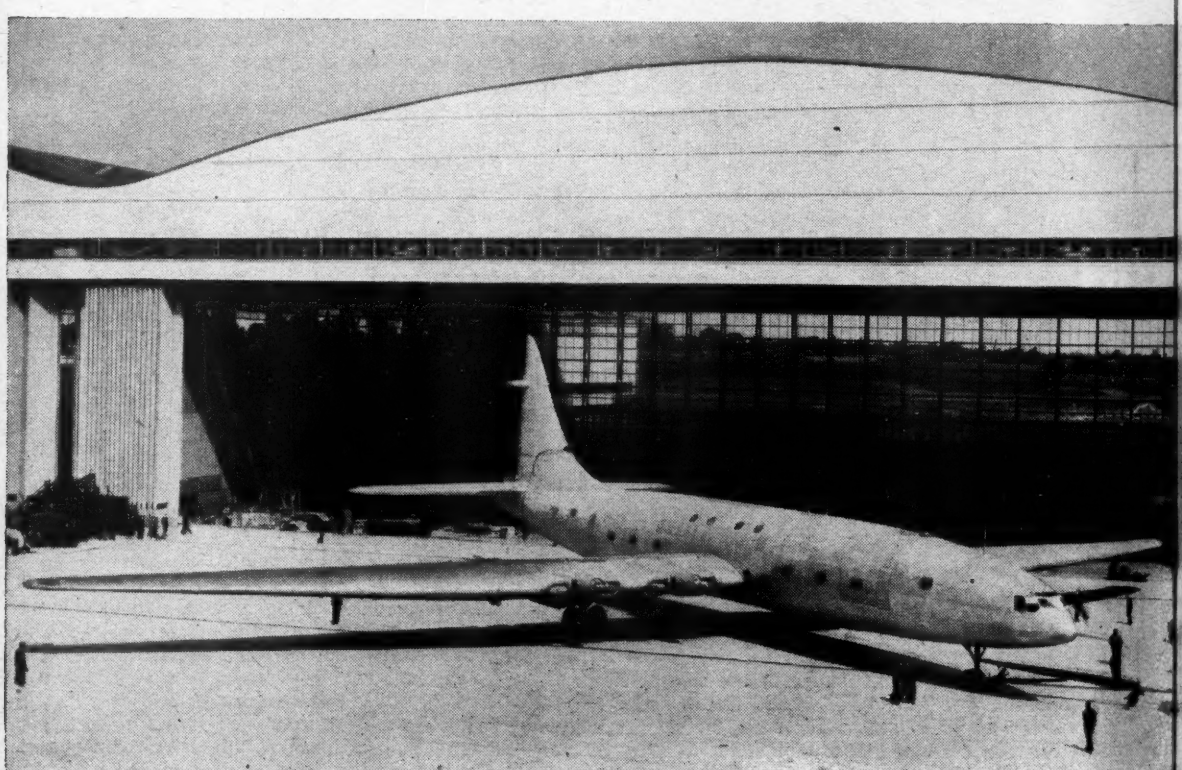
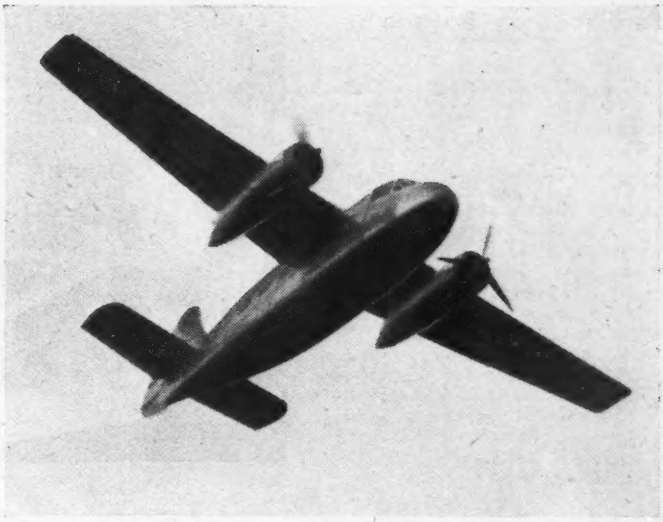


SNIFFING THE BREEZE: *The prototype Bristol Brabazon I (four coupled pairs of Centaurus piston engines) was given an airing on August 17th when the time arrived for fuel-flow calibration tests. Her twenty-seven tanks hold 13,500 gallons. It will be seen that certain essential components are still lacking; nevertheless this graceful monster may fly before the year's end.*

PERCIVALS ON PARADE

The Prince Comes Out: First Demonstration of the Prentice T.Mk.2



The Prince flies with port engine "out" during its first public demonstration at Luton.

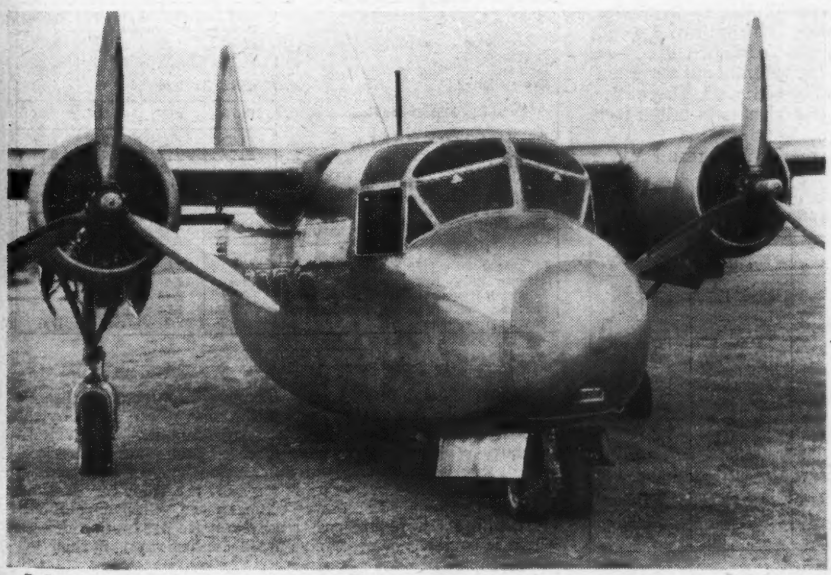
A GREAT deal of interest has been occasioned by the introduction of the Percival Prince, not only as a result of its many desirable features, but because it offers another attractive choice to the many operators who must soon replace their worthy old Rapides. A lively performance is offered on its two Alvis Leonides radials—a maximum speed of 225 m.p.h. and cruising at nearly 180 m.p.h. on 50 per cent power—and it is understood that the Prince is able to meet I.C.A.O. requirements for single-engine performance. Take-off output is 520 b.h.p. per engine. It augurs well for the aircraft that the bulk of its flight trials have been completed successfully in a matter of weeks and without any noteworthy alterations. Confirmation of the granting of a Certificate of Airworthiness is expected during the next few days.

Unfortunately, the first demonstration flight for the Press was upset by a heavy rain storm. W/C. H. P. Powell, A.F.C., was nevertheless able to pass over once or twice at speed and to fly for a few moments with the port engine feathered. The quietness of the Leonides was noteworthy and results from the rearranged, single, collective exhaust outlets on the outsides of each engine. Only at maximum r.p.m. does airscrew noise become apparent.

The prototype is now fully furnished, although there are still some small improvements to be embodied. These and exterior paint will be added for its Farnborough appearance. Uninflammable glass and plastic products have been ingeniously employed for cabin furnishing and soundproofing, and rubber flooring in cabin and cockpit has proved remarkably good for damping small vibrations otherwise detected through the sensitive soles of one's feet. Very sensibly the roof escape hatch has been fitted with small, transparent panels. Such roof lights are most desirable in passenger cabins because they give a larger, airier appearance to the compartment.

Pilots will readily take to the Prince cockpit, which is planned in a most practical manner and offers a fine outlook. A neat 180-deg.-beam Harley lamp is now fitted, which may later be made retractable. Wing, tail and airscrew deicing is also provided. One could not help but question the wisdom of accepting so little ground clearance below the nose wheel doors on an aircraft which may be expected to operate from indifferent runway-less airfields.

Some interesting operating data have been calculated for the Prince, of which a summary follows. They are based on a cost price of £20,000 and a 20 per cent yearly depreciation, insurance at 6.5 per cent of cost and interest at 3 per cent of cost of aircraft and spares. Total fixed cost per year up to 1,000 hours flying time (one crew—pilot and navigator) is thus estimated at £7,880, and for 1,000 to 2,000 hours (two crews) £9,740 Details of operating cost calculations for 500, 1,000, 1,500 and 2,000-hour utilization are tabulated at the foot of the following page. For the pence per mile figures, an allowance has been made for take-off, climb, etc., giving a journey speed of 156 m.p.h.



The large, transparent panels of the cockpit enclosure ensure a good all-round view for the pilot. Note the clean engine nacelles, the twin nose-wheel and the compact 180-deg.-beam lamp buried in the nose.

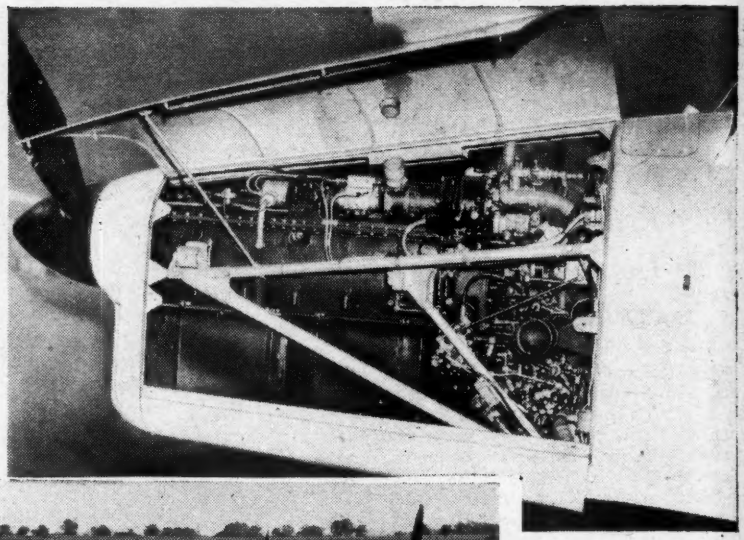
Prentice with more Power

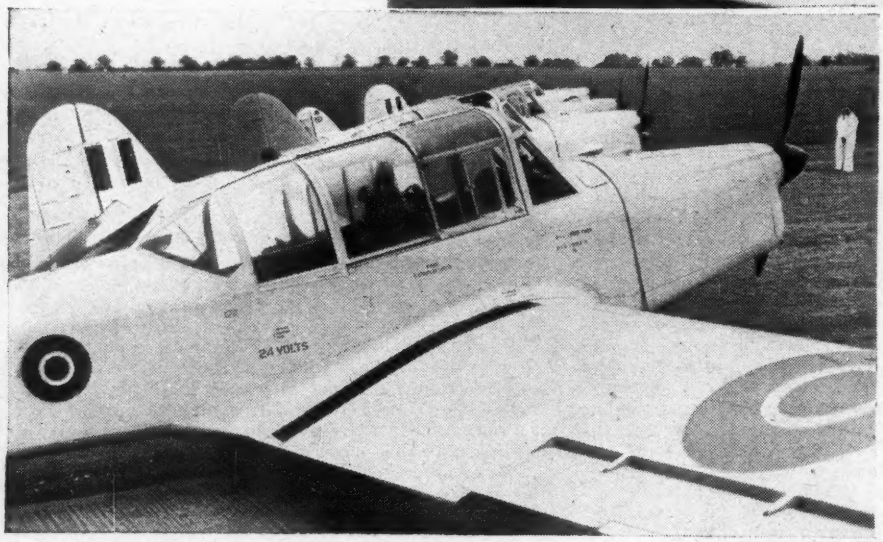
Immediately before the Prince demonstration three Prentices gave a brief, but very acceptable, display of formation flying. The pilots were R. G. Weldon, Percival test pilot; W/C. A. N. Kingwill, Service Liaison Officer; and J. S. Arnold, C.F.I. of the Luton Club. Dick Weldon's machine was the first T. Mk. 2 with supercharged Gipsy Queen 51 engine. This mark is intended primarily

Percivals on Parade . . .

for operation in hot climates and from airfields at high altitude, but might also be adopted for use in this country.

The additional 45 h.p.—the Queen 51 gives 295 h.p.—greatly improves the Prentice's performance, and any lingering doubts about its aerobatic qualities were dispelled in some minutes of individual demonstration, commencing with no fewer than twelve turns of spin, all clearly visible from the outset at about 5,000ft. The first few turns were steep, then the spin was flattened out, and finally steepened again before recovery. After the spin, Weldon, who is to demonstrate the Prentice at Farnborough, went through a series of clean and convincing rolls and rolls off the top with just sufficient height for safety.





Nearest aircraft in the Prentice line-up is the T. Mk. 2 with supercharger D.H. Gipsy Queen 51 engine. The air intake is on the port side. The odd tail just visible among the Prentices belongs to the Gull Six originally owned by Miss Jean Batten. (Above) the compact Queen 51 installation with supercharger casing and air intake visible at the rear end.

Externally, the nose of the Prentice T. Mk. 2 with Queen 51 is hardly distinguishable from the T. Mk. 1. However, the port-side air intake gives it away. The improved speed, and particularly rate of climb, of the T. Mk. 2 will answer the main criticism still levelled by some pilots at the Prentice. Experiments are being conducted with alternative tail designs, a lengthened fuselage and a twin-tail layout being under consideration.

Principal performance data for the T. Mk. 1 and Mk. 2 at full load are as follows:—

PRENTICE PERFORMANCE DATA

	T. Mk. 1	T. Mk. 2
Max speed at S.L.	150 m.p.h.	150 m.p.h.
Max speed at altitude	146 m.p.h.	168 m.p.h.
Max. cont. cruising (at 2,200ft and 5,400ft respect.)	145 m.p.h.	156 m.p.h.
Economical cruising (at 3,500ft and 12,200ft respect.)	140 m.p.h.	155 m.p.h.
Flaps-down stalling speed (crew of 2)	55 m.p.h.	5.2 m.p.h.
Max. rate of climb at S.L.	700ft/min.	920ft/min.
Max. rate of climb at 5,000ft	500ft/min.	700ft/min.
Time of climb to 5,000ft	8.3 min.	7.1 min.
Max. range at S.L. (133 m.p.h. and 129 m.p.h. respect.)	454 miles	505 miles
Max. range at 5,000ft (138 and 139 m.p.h. respect.)	485 miles	517 miles
All-up weight	3,950lb	4,000lb
Take-off in still air (Mk. 1 normal temp., Mk. 2 tropical temp.)		
S.L. from concrete	175 yd.	205 yd.
S.L. from grass to clear 50ft	390 yd.	420 yd.
At 5,000ft from grass to clear 50ft	—	435 yd.

PRINCE OPERATING COSTS

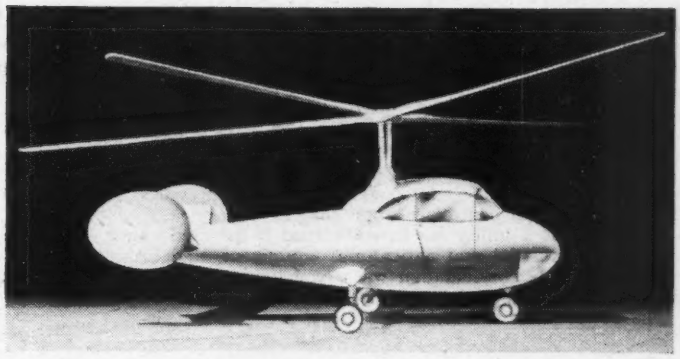
	Flying Hours per Year			
	500	1,000	1,500	2,000
Depreciation	£8.00	4.00	2.67	2.00
Insurance	£2.60	1.30	0.87	0.65
Interest	£1.44	0.72	0.48	0.36
Crew's Salary	£3.72	1.86	2.48	1.86
Total Fixed Costs per Hour	£15.76	7.88	6.50	4.87
Petrol and Oil (176 m.p.h.)	£3.02	3.02	3.02	3.02
Airframe Maintenance	£0.97	0.97	0.97	0.97
Engine Maintenance	£0.76	0.76	0,76	0.76
Total Flying Costs per Hour	£4.75	4.75	4.75	4.75
Total Direct Costs per Hour	£20.51	12.63	11.25	9.62
Pence per mile (156 m.p.h. "journey speed")	31.6	19.4	17.3	14.8
Pence per Passenger mile (8 passengers)	3.95	2.43	2.16	1.85
Pence per Passenger mile (10 passengers)	3.16	1.94	1.73	1.48
Pence per ton mile	36.2	22.3	19.9	17.0

AIRCRAFT PURCHASING METHODS

RECOMMENDATIONS on methods for purchasing aircraft for the British airline corporations have been made by the special committee set up by Mr. Attlee and led by Mr. J. C. Hanbury-Williams. They have received preliminary consideration by the Government, but no decision has yet been arrived at. Rumours have been circulating that the three corporations were to be given complete freedom in the purchasing of aircraft, in order to reduce costs and eliminate production delays. There is so far, however, no official confirmation of this.

KAMAN K-190

An American Helicopter with Servo-control of Intermeshing See-saw Rotors



This model of the K-190-A shows how the passenger version of the utility machine may look

AMONG the many helicopter configurations now undergoing development trials in the United States, the Kaman K-190 is of particular interest on account of certain unusual features of its rotor system. Put very briefly, this comprises two intermeshing two-bladed rotors, the blades being of the "rigid" type without flapping hinges, the two blades of each rotor see-sawing about a single central hinge instead, as in the single-rotor Bell, to mention a type which is familiar in this country.

Where the Kaman breaks new ground, however, is in the operation of the cyclic pitch of the rotors. There is no bearing for the root of the blades in the rotor hub. Pitch is changed by the somewhat daring expedient of twisting the actual blades between the root and the three-quarter radius station. The K-190 has been under test for a long time, and is at present undergoing a series for the Civil Aeronautics Administration certificate. It had previously completed a 100-hour endurance test on the ground, during which the rotors and transmission were deliberately "thrashed" in order to discover any weak points. Apparently the whole mechanism stood up to the ordeal.

Twisting of the rotor blades requires a considerable force, and the Kaman engineers achieve this by using servo flaps mounted a short distance behind the blades, the pilot controlling the flaps which, in turn, control the blade twist. The system may be likened to an aircraft wing so weak in twist that it gives reversed control. That is to say that a negative angle on the servo flap increases the angle of the main surface and thus increases its lift. That the solution of the problems connected with this form of control was no easy matter will be appreciated when we point out that it took the Kaman engineers two years of theoretical analysis and experimental verification, but the results appear to justify the work. One great advantage, from the pilot's point of view, of the Kaman system is that the control loads on the collective and cyclic pitch sticks are very light, and there is scarcely any feed-back. The most doubtful point seems to be the structural effect of twisting the blades, but the prolonged fatigue tests made appear to have disclosed no weakness after a vast number of reversals. It should be explained here that the blades are made of solid wood, being formed from a block of laminated spruce planks.

Torsion and Flutter

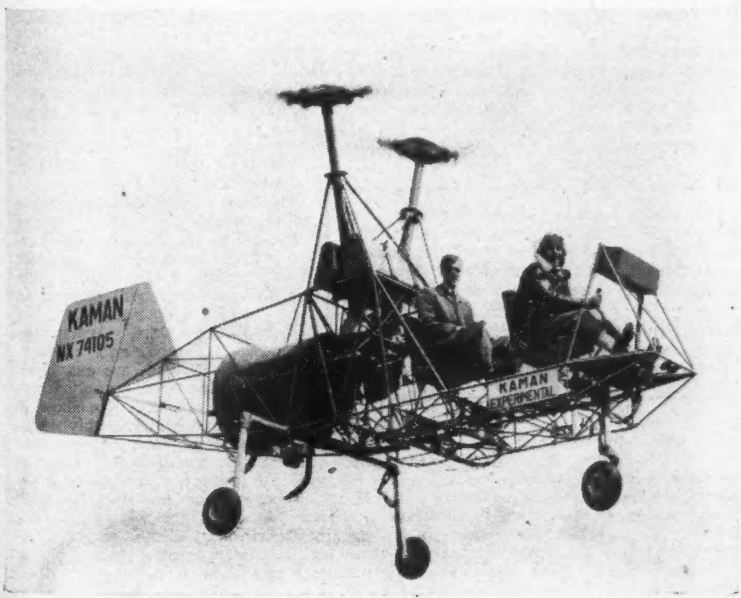
The designers explain that whereas conventionally controlled blades require high torsional stiffness to avoid torsional deflection, the Kaman blades are of low stiffness, both in bending and torsion, and that as a result the machine is smooth and free from vibration. The presence of the servo flap behind the blade is claimed to improve the flutter characteristics, and another advantage of the use of such a flap is that it has been possible to get away from the symmetrical aerofoil section in the blades and to use instead a section of high lift and low drag, thereby achieving a wider operational range before tip stalling sets in at high forward speeds.

Pilot's controls in the Kaman helicopter are conventional, there being a cyclic stick, a collective pitch stick incorporating the throttle, and rudder pedals. By means of a torque tube and push-pull rods the sticks and pedals are connected to the collective pitch forks and gimbal ring assemblies located at the base of the rotor shafts. Control applied to these assemblies is transferred through push-pull rods inside the hollow rotor shafts, through bell cranks at the rotor hub to push-pull rods located in the blade leading edge, and finally through a bell crank in the servo flap bracket to attach directly to the servo flap hinge.

Cyclic control is obtained by tilting the gimbal ring assembly, thereby causing a rocking motion which is carried to the servo flap as the gimbal ring rotates with the rotor.

Movement of the collective pitch stick raises and lowers the two gimbal ring assemblies simultaneously by means of the hinged collective pitch forks. This provides equal pitch increase or decrease to all servo flaps through the full 360 deg sweep of the rotor.

The rudder pedals raise and lower the two gimbal ring assemblies alter-



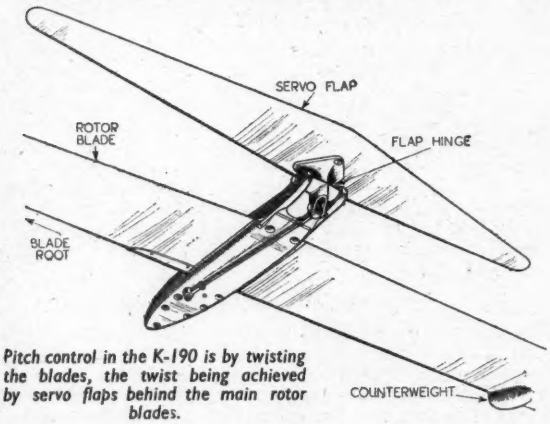
As it is intended mainly for pest destruction and similar work, accessibility for maintenance was considered of primary importance in the K-190 utility helicopter, hence the open framework.

Kaman K-190 . . . . .

nately by means of the collective pitch forks, which movement increases the collective pitch of one rotor while decreasing the collective pitch of the other. This provides a torque differential between the rotors, which is utilized for directional control. In addition, the rudder pedals are connected to a normal rudder, which not only results in greater manœuvrability in forward flight but also provides positive directional control in autorotation.

The K-190 is a utility machine designed to be used as a piece of industrial and agricultural equipment, and in the design prime consideration was given to maintenance accessibility and dependability of operation.

The power plant is a Lycoming o-435, six-cylinder, air-

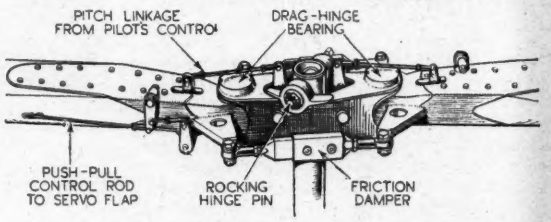


Pitch control in the K-190 is by twisting the blades, the twist being achieved by servo flaps behind the main rotor blades.

cooled engine, with a maximum rating of 190 h.p. at 2,550 r.p.m. The engine is located below and to the rear of the main transmission. Fuel supply is by gravity feed from two inter-connected tanks located fore and aft of the rotor shafts above the transmission. Capacity of the tanks is 32 American gallons. The engine is mounted so as to face to the rear, the purpose being to provide maximum accessibility for engine maintenance and replacement.

Engine cooling is accomplished by a 35in diameter, twelve-bladed fan splined to the engine propeller-shaft and surrounded by a collector ring which directs the cooling air to the engine cooling pressure box.

A centrifugal clutch is mounted on the engine side of the fan disc. The clutch engages at 1,200 to 1,500 engine r.p.m. and drives a simple two spur gear transmission mounted on the engine nose. This engine nose transmission, which has a 1.1 : 1 gear ratio, transmits power to the drive shaft which, in turn, drives the main transmission via a free-wheeling unit incorporated for purposes of auto-



The rotor blades of the K-190 are of the see-saw type, and pitch control is by cranks and push-pull rods from control sticks to servo flaps.

rotation. A single-disc hydraulic rotor brake is located on the main transmission at the free-wheeling unit to provide quick stopping of the rotors after the engine is stopped.

Gear ratio in the main transmission is 10.5 : 1 and this, together with the 1.1 : 1 ratio in the nose transmission, gives a ratio of 11.55 : 1 between the engine and the rotors. A change in ratio between engine speed and rotor speed is accomplished by replacement of the inexpensive spur gears in the nose transmission only.

The rotor shafts are built in two pieces, being flange-bolted just above the main transmission, thereby facilitating installation of the shafts. The shafts are of simple construction, being chrome molybdenum tubing, with the mating flange welded at the bottom and a cross tube for the hub drive welded at the top.

Main data relating to the Kaman K-190 are: Weight empty, 1,700 lb; disposable load, 800 lb; gross weight, 2,500 lb; seating capacity, pilot and two passengers or equivalent cargo; range, 235 miles at 70 m.p.h.; operational ceiling 11,000ft (presumably with forward speed); power loading, 13.2 lb/h.p.

FARNBOROUGH LINE-UP

THOUGH last-minute surprises, and possibly some disappointments, may be expected, the latest schedule of aircraft due to be flown and/or exhibited at the S.B.A.C. Display, to be held at Farnborough from September 7th to 12th, gives a good idea of the scale and scope of this year's event. Especially significant is the fact that, of 64 machines listed, no fewer than 19 have either turbojet or turboprop power plants, and five are rotating-wing machines. The various manufacturers to be represented, with their aircraft, are set out alphabetically below.

Airspeed: Ambassador, Consul. *Armstrong Whitworth:* A.W.52 (2 Nene), A.W.52 (2 Derwent). *Auster:* Autocrat, Avis, T.Mk.7, A.2/45. *Blackburn:* S.28/43, Firebrand 5. *Boulton Paul:* Balliol 1, Balliol 2. *Bristol:* New Type 170 (Freighter XXI, E), Brigand B.I., Type 171 Mk. 2 helicopter. *Chrislea:* Super Ace (uncertain). *Cierva:* Air Horse, Skeeter (unlikely to fly). *de Havilland:* D.H.108, Sea Hornet, Dove, Chipmunk, Vampire 5. *Elliott of Newbury:* Eon (Major X), Olympia, Baby and Primary Eon gliders. *Fairey:* Gyrodyne, Primer, Operational Trainer, Firefly Mk. 4, Firefly target-tower. *General Aircraft:* One type of tail-less research glider, Mosquito target tower. *Gloster:* Meteor 4, Meteor 7, E.1/44. *Handley Page:* Hastings 1, Hermes IV, Miles Marathon. *Hawker:* P.1040, N.7/46, Sea Fury. *Napier:* Naiad-Lincoln. *Percival:* Prince, Prentice 1, Prentice 2. *Planet:* Satellite. *A. V. Roe:* Athena 1, Athena 2, Dart-Athena (possible), Tudor VIII, Shackleton (unlikely), Lincoln Tudor IV, Tudor VII (possible). *Saunders-Roe:* S.R./A1. *Scottish Aviation:* Prestwick Pioneer. *Short:* Sealand, Sturgeon 2, Solent. *Vickers-Armstrongs:* Nene-Viking, Viscount, Valetta. *Vickers-Supermarine:* Attacker, Seagull, Spitfire Trainer. *Westland:* S.51 helicopter.

THREE forthcoming issues of "Flight," reviewing the products of the British aircraft industry, and describing in detail the Society of British Aircraft Constructors Display and Exhibition at Farnborough, will prove of particular interest to readers at home and overseas. They are :—

September 2nd : "Farnborough Preview"
" 9th : "Britain's Aircraft Industry"
" 16th : "The Farnborough Display"

Very few entirely new power units are expected at Farnborough this year, although Blackburns are preparing to show the Bombardier and Grenadier for the first time. Many of the units, particularly gas turbines, in development form last year, will be present as complete installations and will perform in new aircraft or test-beds. The Rolls-Royce Dart, Armstrong-Siddeley Mamba, and possibly the Napier Naiad, are examples. Certain companies, notably Rolls-Royce, have decided to show in the static exhibition only those units which they have to offer for sale to home and overseas buyers. Thus the Dart will not be on the Rolls-Royce stand.

Whereas at Radlett last year the number of exhibitors in the Static Display totalled 155, there will be 190 stands in this section of the show this year. Other things being equal, the maintenance of a leading position in the aeronautical world is a function of the quality of equipment. On that score, the exhibition at Farnborough should be a reassurance of this country's capacities.

B S

CIVIL AVIATION NEWS

FRENCH SURVEYOR : First tests of the Aérosudest S.E. 1010 are progressing. The aircraft is intended for photographic survey at high altitudes and will be used by the I.G.N., the French National Geographic Institution for the air survey of Africa. The aircraft is powered by 4 Gnome-Rhône 14.R engines.

Financial Reports of Two Airlines : State Training Scheme Failure : Airwork Expansion in Africa

K.L.M. PROFIT

IN the annual report for 1947 K.L.M. has declared a net profit of £13,200. A dividend was proposed and accepted. Net income in 1946 was 69,500,000 guilders, and it had risen to 105,600,000 guilders in 1947. The total number of passengers increased by 39 per cent over the previous year, and the volume of air freight rose by 113 per cent. The most profitable route was from Amsterdam to Batavia, which showed an increase over the previous year of 8,500,000 guilders. Receipts on other lines were as follows: European, 18,200,000 guilders; North Atlantic, 18,100,000 guilders; West Indies, 9,800,000 guilders; South Atlantic, 8,500,000 guilders; South Africa, 3,600,000 guilders. At the end of last year the Dutch airline was operating 70 aircraft which, although less than at the end of 1946, represented a larger carrying capacity owing to the use of larger and more modern aircraft. The K.L.M. report shows that all services showed substantial increases with the exception of internal routes, which, it is said, were affected by the general improvement in road and rail transportation throughout Holland during the year.

AIRWAYS TRAINING CLOSING

AS from the end of September, Airways Training, Limited, will be closed down. The company was formed by B.O.A.C. and B.E.A.C. at Aldermaston on April 30th, 1947, for training aircrews and technical staff for the two corporations. As the training requirements were met and a surplus of facilities became available at Aldermaston towards the beginning of this year it was decided to throw open the school to private individuals, other operating companies and foreign governments. The response has proved unsatisfactory, however, and in the interests of economy the corporations have decided to close down the establishment and carry on with training at their own bases.

AER LINGUS REPORT

AFTER repayment of all the sums provided by the Exchequer for share capital, development and other expenses, Aerlinte Eireann will have a surplus of about £60,000, due primarily to profits on the sale of the company's five Constellations. Dublin airport showed a profit of £10,700 as against an estimated loss of £15,000. Aer Lingus showed a loss for the year which totalled £608,421, of which 50 per cent will be borne by the British corporations. During the year under review route mileage increased by over 145 per cent over the previous year and is now 2,516. Passengers carried increased to 156,532 from 76,304. Cargo also increased from 666,000lb to 1,658,000lb. Total gross revenue was £892,314 compared with £377,345 in the year 1946-47. In landing charges Dublin airport earned £56,173, as against £11,350 the previous year, and the number of passengers using the airport totalled 162,761. The airport has handled 2,196,491lb of freight and 88,539lb of mail.

Abandonment of the transatlantic route by Aerlinte Eireann involved a reduction in staff of 639 from 2,270 in December, 1947, to 1,631 at present. In order to improve the financial prospects of Aer Lingus there will be an increase in passenger fares on a number of routes and an intensive effort is to be made for developing the cargo-carrying side of the company's services. The report states that unexpectedly heavy maintenance expenses for new aircraft and substantial increases in wages and other causes contributed to the Aer Lingus deficit. Attention is drawn to the fact that despite rapid expansion the company's 100 per cent safety record has been maintained.

SHOREHAM-COWES-SOUTHAMPTON

BROOKLANDS AVIATION, LTD., have been granted a licence to run scheduled airline services from Shoreham to Southampton via Cowes, Isle of Wight. The service, which started on August 6th, is, of course, in association with British European Airways and will link up with the Corporation's Channel Islands service. D.H. Rapides will leave Shoreham twice daily, at 0950 and 1630 hours, arriving at Cowes at 1029 and 1704 hours. After a 10-minute interval the aircraft will take off and arrive at Southampton at 1055 and 1730 hours. Services in the other direction will leave Southampton at 1130 and 1750 hours, arriving at Shoreham at 1230 and 1850 hours. Fares from Shoreham to Cowes are: single £1 10s, monthly return £2 18s; from Shoreham to Southampton the fare is £2 5s single, £3 15s monthly return; and from Cowes to Southampton 15s single, 18s return, and £1 1s monthly return.

FLASHING NAVIGATION LIGHTS

IN order to avoid confusion between flashing navigation lights on aircraft, and the switching on and off of navigation lights by aircraft seeking to draw attention in an emer-

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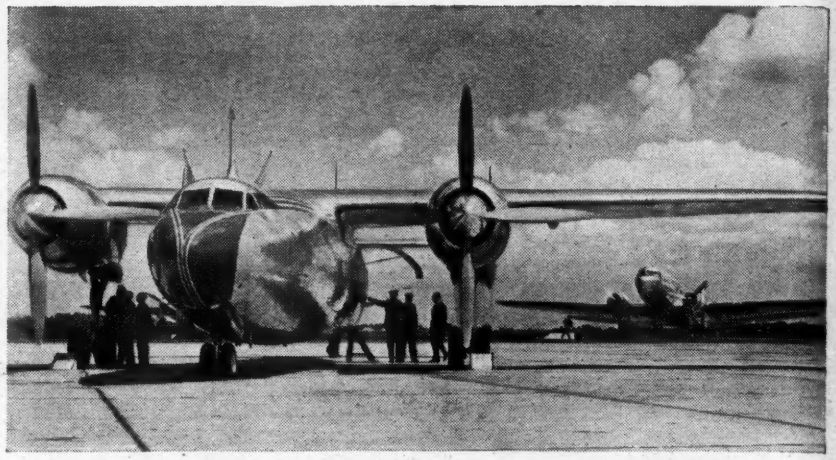
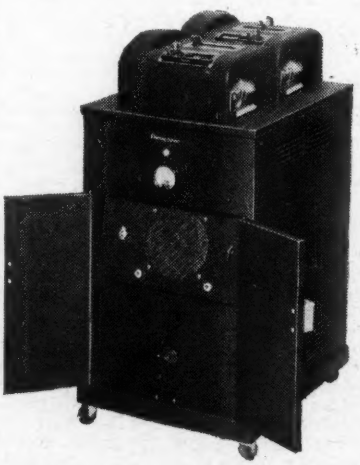
gency, pilots are requested by the M.C.A. to ensure that emergency flashing is obviously irregular. It was a rule before and during the war that an aircraft in distress and unable to communicate with the ground by other means should indicate an emergency by circling and flashing navigation lights. American aircraft are now equipped with lights which flash at regular intervals, the purpose being to distinguish them from other lighted objects, particularly when on the ground. Experiments are under way at the R.A.E., Farnborough, with three different systems of flashing lights for British aircraft. The system of switching lights erratically on and off in emergency still applies in the United Kingdom.



OUTSTANDING VISITOR: Away from familiar surroundings in Hampshire but in its natural environment, the Ambassador was resplendent on the tarmac at Northolt during a recent visit. Great interest was aroused at this airport, where in several years' time the Ambassador will be well known.

CONTROL RECORDING

AS announced in *Flight*, August 19th, all conversation between aircraft crews and controllers at Northolt and London Airports will now be recorded. The Dictaphone Company, Limited, of 107, Kingsway, London, have installed eight Dictaphone Belt recorder/reproducers at each airport. One machine has been allocated to each Control tower frequency and three to the Ground Controlled Approach frequencies. The installation is contained in the equipment rooms of the airport control towers at each airport. Not only do the machines record and log all R/T conversations, but they also serve as monitors for reception and transmission, since each Dictaphone A2M machine is connected to an independent receiver which picks up all audio signals on the frequency to which it is tuned. On each set is a meter to indicate whether signals are in fact being recorded, and in such a way a continuous check is kept on the efficiency of each transmitter whether on the ground or in an aircraft. The A2M machine records, by means of lateral embossing, 30 minutes of continuous speech on a plastic belt 12½in in circumference and 3½in wide. An automatic change-over mechanism provides a 20-30 second overlap and ensures continuity, and an automatic device controls the machine so that no recording is made unless conversations are taking place. Recorded material may be filed under time, date and frequency. The system has been in use for some time in America for air traffic control, with the approval of the Civil Aeronautics Administration and by airlines for logging radio/telephone communications.



A Dictaphone Belt recorder/reproducer.

APOLLO FURNISHINGS

ALTHOUGH the Appollo has not yet reached the stage where cabin furnishings can be installed, the full-scale mock-up does enable one to see what the finished aircraft will be like. The whole of the walls and ceiling surfaces are finished in very pale grey-green Vynide based on a dark sage-green skirting, the only relief from this general tone scheme being the central strip lighting panel in the ridge flat of the ceiling. Windows are curtained with a silver-green patterned fabric, which affords pleasant contrast to the grey-green moquette in which the chairs are covered. Seating is given in paired-chair units, using a tubular chassis with wooden panels to the outer arm rests; the central arm rests fold into squab recesses. Across the backs of the paired seats are net racks and flap tables which fold down to rest on the rack frame. These tables are finished in walnut, and steward call-buttons are incorporated in the top centre of the squabs. The floor of the cabin is carpeted throughout in grey-green moquette of slightly deeper shades than that used for the chair upholstery.

SOLENT MODIFICATIONS

WING floats on the Short Solent flying boats have been placed some 7ft further outboard on each wing and 1½ft forward. "Vee"-strut bracing has replaced the original fitting and the wing spar is being strengthened in the new vicinity of the floats. B.O.A.C. withdrew Solents from the South African service on July 22nd, and two of the flying boats were flown to Short and Harland at Belfast, where they are now in the process of being modified. The remainder will be modified at Hythe, the Corporation's flying-boat maintenance base, with some assistance from Short and Harland. It is hoped the first aircraft will be completed by the end of this month and soon return to service.

B.S.A.A. WEST INDIES SERVICES

A NEW weekly service between London and Kingston, Jamaica, is now being operated by B.S.A.A., using 32-seater Tudor IV aircraft. The service leaves London Airport on Thursdays at 10.30 hours (local time), and is routed via Keflavik (Iceland), Gander, Bermuda and Nassau, reaching Kingston the following day at 14.40 hours (local time). On the return flight, the service leaves Kingston on Saturdays at 11.00 hours, calls at Nassau, stops overnight at Bermuda, and arrives at London Airport, via Gander and Shannon, on Mondays at 13.45 hours. The Corporation recently completed the transfer of their maintenance and engineering base from Kingston to Nassau. Since the station opened in March, 1947, flight movements there have increased from two to twelve a week. In addition to the Tudor IV service, B.S.A.A. also operate two other weekly services to the West Indies, via the Azores, with departures on Tuesdays and Saturdays.

AIRWORK IN EAST AFRICA

A NEW company, Airwork (East Africa), Ltd., has been formed with headquarters in Nairobi to take over existing aircraft interests of the Uganda Co., Ltd., and Airwork, Ltd., in East Africa. Although the new company will be controlled by Airwork, Ltd., the Uganda Co. will still be represented both in shareholding and by seats on the board of directors, which consists of Sir Alfred Vincent (chairman), Lt. Col. B. A. Wilson (managing director), Mr. M. D. N. Wyatt, Mr. Alexander M. T. B. Noon, Mr. Joseph T. Simpson and Mr. D. Elphick. The new company has also acquired an interest

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in Messrs. Noon and Pearce, Ltd., a charter company operating 2 de Havilland Dominies, 3 Austers, 6 Miles Geminis, 1 D.H. Fox Moth, 3 Stinson Reliants, and 1 D.H. Moth Minor. The purpose in amalgamating with local air operators was to ensure good maintenance service and provide an effective freight and charter organization to operate anywhere between Cairo and Johannesburg. Bristol Freighters are already active in the area on behalf of the company carrying considerable quantities of freight and passengers, especially in the Tanganyika territory. A constant supply of food is sent by air into Dar-es-Salaam. The company are examining the possibilities of supplying equipment and food by parachute to outlying areas where it is impossible for aircraft to land. Similar schemes have been operated for some time by Airwork in Ecuador.

An experiment is being undertaken in conjunction with the Colonial Office Insecticide Committee on behalf of the Uganda Government in aerial spraying against tsetse fly. Two aircraft and the necessary crews will be based on four islands on Lake Victoria, but with headquarters at Entebbe.

BREVITIES

THE Australian aircraft register has reached a total of 701 aircraft, compared with 336 in 1939. Of the present total, 258 are Tiger Moths.

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It is said that British Commonwealth Pacific Airlines is negotiating for the purchase of Canadair Fours. The company is using Skymasters on the Sydney-Vancouver route.

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Ronaldsway airport handled, during July this year, a total number of 17,495 passengers, as against 9,494 in the corresponding month the previous year. For the period April 1st to July 31st the total number of passengers handled at the airport came to 43,246. These figures include passengers carried by B.E.A.C., Aer Lingus, and by charter companies.

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Mr. H. Caplan and Mr. N. H. Wood, both graduates of the College of Aeronautics, Cranfield, have now joined the technical department of British Aviation Services, Limited. They will be concerned mainly with the investigation of aviation accidents and aircraft repair methods on behalf of underwriters, and will also be responsible for other technical services offered by the company.

* * *

Sir William McNair, K.C., who has been appointed by the Minister of Civil Aviation to hold an inquiry into the loss of the Swedish aircraft SE-BDA which came into collision with an R.A.F. Transport Command York near Northolt on July 4th (as reported in *Flight*, July 8th), will open his investigation in public at the Law Courts on September 20th. Investigation into the loss of the R.A.F. aircraft is the responsibility of the Air Ministry.

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Preliminary work is in hand for the installation of lighting at six of New Zealand's main airfields, and it is hoped that within a few months the first night services will start operations throughout the country. Since 1935 there have been substantial increases in traffic, as is shown by figures published recently by the Air Department. During 1935 31,500 miles were flown, 595 passengers carried, freight ton-miles came to 120, and mail ton-miles totalled 75. In the first half of 1948 alone 3,320,992 miles were flown, 154,329 passengers were carried, freight ton-miles totalled 126,010, and mail ton-miles 97,310.

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During the first week of operations the mixed fleet of 13 civil aircraft raised by the charter section of B.E.A. from nine air charter companies in Britain has averaged over eight flying hours daily per aircraft. The round trip from bases in Western Germany to Berlin and return takes about 2 hours 20 minutes, including the turn-round at Gatow airport, and an average of five trips a day has been maintained. The fleet, consisting of 10 Dakotas, a Liberator, a Halifax and a Hythe flying-boat, carries approximately 50 tons on each trip. Twelve of the aircraft have been retained for further service. The original charter was for 14 days, expiring on August 19th, but an extension has been made initially for a further seven days.

From Easter to mid-June this year 76,000 persons used the visitors' enclosure at London Airport; takings totalled £1,200. In the five months that the enclosure was open last year there were 246,000 visitors and 22,800 cars, and the takings were £4,300.

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The Scottish GEE chain referred to in *Flight*, October 16th, 1947, has now been brought into operation on an experimental basis. Owing to the temporary-site limitations at two of the stations coverage will be lower during the experimental period than will obtain when the chain becomes fully operational. Full facilities will be introduced as soon as possible.

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Two of New Zealand's most experienced civil aircraft pilots, Commanders M. C. MacLeod and R. J. R. H. Makgill, A.F.C., were killed on August 9th when a Dakota they were flying crashed on a 1,700-ft. hill 20 miles north-east of Blenheim. Both pilots had flown more than 7,500 hours. The aircraft was engaged in the Cook Strait air freight service and apparently struck the hill in cloud, three miles to port of track. There were no passengers.

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Speaking at the christening ceremony of the Mercury Airways Skyliner *City of Capetown*, Mr. P. O. Sauer, South African Minister for Transport, said that there was a place for both government-owned and private airlines in South Africa. It would be his endeavour, he said, to see both working with as much harmony as possible. The *City of Capetown* recently landed in England despite the M.C.A. ban on certain passenger-carrying flights over the S. Africa-U.K. route.

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Messrs. James Burness and Sons, Limited, of London, are acting as agents for the Ministry of Food to fly 50,000 gallons of milk a day from Northern Ireland to England. So far the company have chartered 13 aircraft: two Halifaxes from the Lancashire Aircraft Corporation, two from British-American Air Services, one from Bond Air Services and one from World Air Freight, Limited; two Dakotas from Air Transport (Charter) (C.I.), Limited, one from Ciros' Aviation, Limited, and two Liberators and two Dakotas from Scottish Aviation, Limited. When the service is in full operation Nutts Corner, the Belfast airport, will have to deal with some 120 additional aircraft movements daily.

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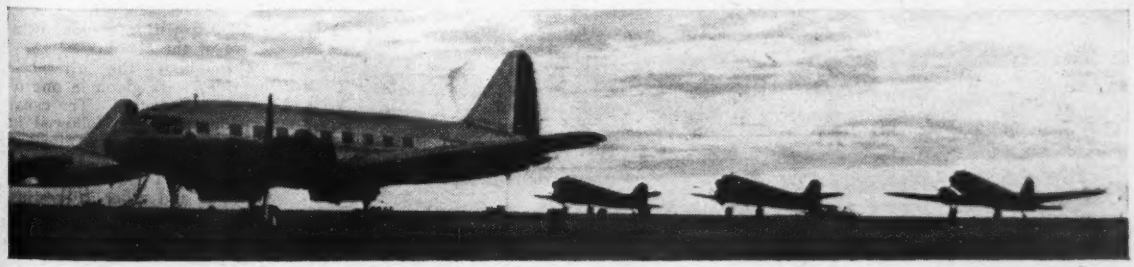
An experimental system of low-intensity approach lighting has been installed on the approach to runway 280 deg. at London Airport. The system consists of two lines of omni-directional red lights of low intensity extending from the runway end to a distance of approximately 4,000 ft. The lines diverge from the runway end at angles of 2 deg. and the lights in each row are 150 ft. apart. A distance marking bar is provided at approximately 1,500 feet from the runway end, consisting of eight red lights and four sodium lights. The system will not be put into general use, but will be displayed



DOUGLAS SKYLINE: With several Dakotas in the background two Russian Il-12s, stand on the airfield at Khabarovsk. These aircraft maintain scheduled services to Moscow.

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at the discretion of Air Traffic Control, London Airport, or on request from pilots.

* * *

Philippine Air Lines Inc. extended its Manila-Madrid service to London on July 26th. The fortnightly flight leaves Manila on Thursday mornings and arrives in London two days later via Calcutta, Karachi, Cairo, Rome and Madrid, the return flight being routed via Madrid, Rome and Athens. Douglas DC-6 aircraft, on which sleeping accommodation is available, are used. The company also operates on internal routes around the islands, in addition to two services a week between Manila, Honolulu and San Francisco, and scheduled services between Manila, Hong Kong and Shanghai.

FROM THE CLUBS

FULL advantage was taken of the good weather conditions for flying during July and fifteen aircraft attended the Deauville Rally, from the Wolverhampton club. Four aircraft visited the La Boule Rally. Several week-end trips have also been made to the Continent, and the club expects the remaining rallies of the season to be well patronised by its members. At least five aircraft are being entered for the Lympne Races and a large contingent from Wolverhampton will be flying down to support the entrants.

Mr. Moseley, of the Fairey Aircraft Company, has been spending a few days at Wolverhampton accompanied by the company's Fairey Junior aircraft. The aircraft was flown by the club's instructors who all praised its flying qualities. Instructional flying hours for July were over the two-hundred mark, and members continued to show great interest in the welfare of the club both in flying and social activities. Mr. D. J. Jemmett and Mr. R. R. Paine entered for the Thruxton Air Races, the former winning the Magister race and finishing fifth in the open scratch race, and the latter finishing fourth in the open scratch race.

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LEA AIRPORT, near Sandown, closed since the beginning of the war, has been reopened by a new company, the Isle of Wight Air Centre. Headquarters of the former Civil Air Guard, Lea ceased to function at the outbreak of the recent war and was turned over to food production. The clubhouse and hangars became derelict. The new company have laid down two runways, the 1,200-yd one being the longest in the Isle of Wight, and much levelling and reseeding has been carried out. The clubhouse has been completely redecorated, now presenting a spacious lounge, licensed bar and office accommodation, and the airport has been granted a licence by the M.C.A. One hangar has also been renovated and two others purchased and in time it is hoped to make Lea one of the leading air centres of the Island.

The company will undertake charter work, and they aim to encourage flying instruction. For £30, they claim, an intelligent pupil can learn to fly and put in up to 15 flying hours. They also hope to introduce a scholarship scheme, by which pupils can reach "A" licence standard. The fleet will consist of Austers, Tigers, Geminis and, later, Rapides. The new concern incorporates the old Island flying and gliding clubs and the model car and aero club and to encourage amenities in this direction they have purchased a glider launching winch and hope to lay down a track for the model work. The new company's directors are Mr. K. A. Hogan and Mr. J. K. Sinclair, with Mr. E. A. Ireland as secretary.

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PRACTICALLY continuous sunshine and an attendance of nearly 2,500 people ensured the success of the Thruxton Air Races held by the Wiltshire School of Flying on August 15th. The first event was a one-class race for Autocrats and was won comfortably by F/L. Snarey, chief test pilot of Austers, who later gave a polished demonstration flight in the Autocrat. Great interest centred round the Chrislea Super Ace, both on the ground and in the air; in the display flight of this aircraft good use was made of a fairly strong wind to show off slow-flying and climbing capabilities. In the speed-judging competition seven people won free flights for correctly judging the speed of an Auster flown across the airfield firing green Verey cartridges. Event No. 7 was the release of an E.O.N. Olympia glider at 3,000 feet; this glider performed for about 20 minutes, finishing with a dive and a loop near the ground before landing. The open handicap race was won by a Spitfire 9 flown by Miss Curtiss, which crossed the finishing line 36 seconds ahead of a Proctor which was followed 2 seconds later by an Auster Arrow; Ron Paine, in his Miles Hawk, was 2 seconds behind the Arrow; the handicapping was done by Messrs. Rowarth and Dancy. The programme finished with a display by the R.A.F. from Andover, which included the bombing of a Horsa which caught fire and was promptly extinguished by the R.A.F. fire party. Pleasure flying proceeded throughout the day and a 3-seater Auster had to be used to supplement the D.H.84 to keep the queue within manageable proportions.

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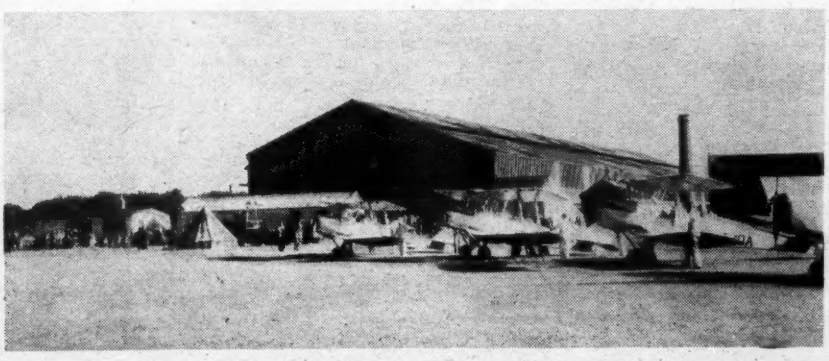
ROCHESTER FLYING CLUB'S "At Home" was at the mercy of a gusty wind on Sunday, August 15th. A number of members from other clubs dodged the frequent showers of the late morning which persisted in the south-east, and the arrival competition was won by Mr. P. Parry in an Auster from the Lancashire Aero Club. Weather forecasts for late afternoon gave hopes for less gusty conditions and the organizers switched the programme in an endeavour to give the less-experienced club members more pleasant conditions for their landing and bombing competitions. The slowest slow roll contest became the first event and Mr. Rex Bennett, chairman of the club, won first prize after tossing with another competitor, F/L. Jock Easy, who had tied with a roll in 18½ seconds. F/L. Arnold and F/L. Easy, both instructors of No. 24 R.F.S., then gave a demonstration of aerobatics in two of the club's Tiger Moths. They started off with a well-executed loop in formation and then went on to individual aerobatics including all the well-known antics with a few of the lesser-known thrown in, most impressive of which was a falling leaf by one, and four barrel rolls in succession by the other.

During the tea interval three trainees from No. 24 R.F.S. flew Tiger Moths in several excellent formations in very bumpy conditions. After tea the wind abated slightly, and the judges, S/L. F. Holt, C.F.I. of the club, and Mr. C. C. H. Dash, decided to hold the bombing competition. The wind, however, proved to be still rather high, and the spectators were unable to see the white puffs as the chalk bags burst on the airfield, but undoubtedly the competitors enjoyed themselves. The final event was a landing competition for pilots with more than 100 hours' flying experience, in which competitors were required to glide-in from 1,500ft and finish near to a line without use of power or side slip. The winner was Mr. A. Bodfield, who finished 11 yds from the line. The bombing competition was won by Mr. R. E. Nightingale, who bombed to within 32 yds of the centre of the circle.

Throughout the afternoon joy rides were given in one of the club's Proctors. The usual joy-ride route was followed in which passengers are given a tour around the Medway towns, with a good look at the *Arethusa* and other interesting landmarks. At the end of the afternoon prizes were presented by Mrs. Chambers, wife of W/C. Tom Chambers, manager of the Rochester Flying Club.



KENTISH 'AT HOME': Competitors preparing to take part in one of the events at Rochester on Sunday, August 15th. Club members and their friends sat outside the clubhouse to watch the flying.

APOLLO

First Post-war Civil Aircraft by Sir W. G. Armstrong Whitworth Ltd.

APOLLO, of all the deities in Greek mythology, was perhaps the most important and many-sided of the dwellers on Parnassus. But it is as the god of colonization, taking emigrants on their voyages, that his name is most aptly given to the new Armstrong Whitworth inter-capital passenger transport, the AW 55. One can also find a link in classic mythology for the Armstrong Siddeley Mamba airscrew turbines which are used to power the Apollo, for among the *fauna* sacred to him is the snake, this connection having a prophetic context which we may hope will be apt to the aircraft's future.

Designed to meet the recommendations of the Brabazon Committee's Type II B classification, the standard version of the Apollo provides a medium-stage, general-purpose transport aircraft for the accommodation of 24 to 31 passengers plus baggage and freight, making a total payload of 7,500 lb. Thus the bare bones of the category. However, technological advances and orthodox practice are sensibly blended in the Apollo design to furnish an aircraft of quite conventional general appearance and layout, but with (i) turboprop power units, (ii) fuselage pressurization and full cabin atmosphere control, and (iii) an advanced form of wing structure giving high torsional rigidity. Additional, but perhaps secondary, refinements are included in the use of thermal de-icing, Fowler flaps and (although not to be fitted to the prototype) a two-part servo rudder.

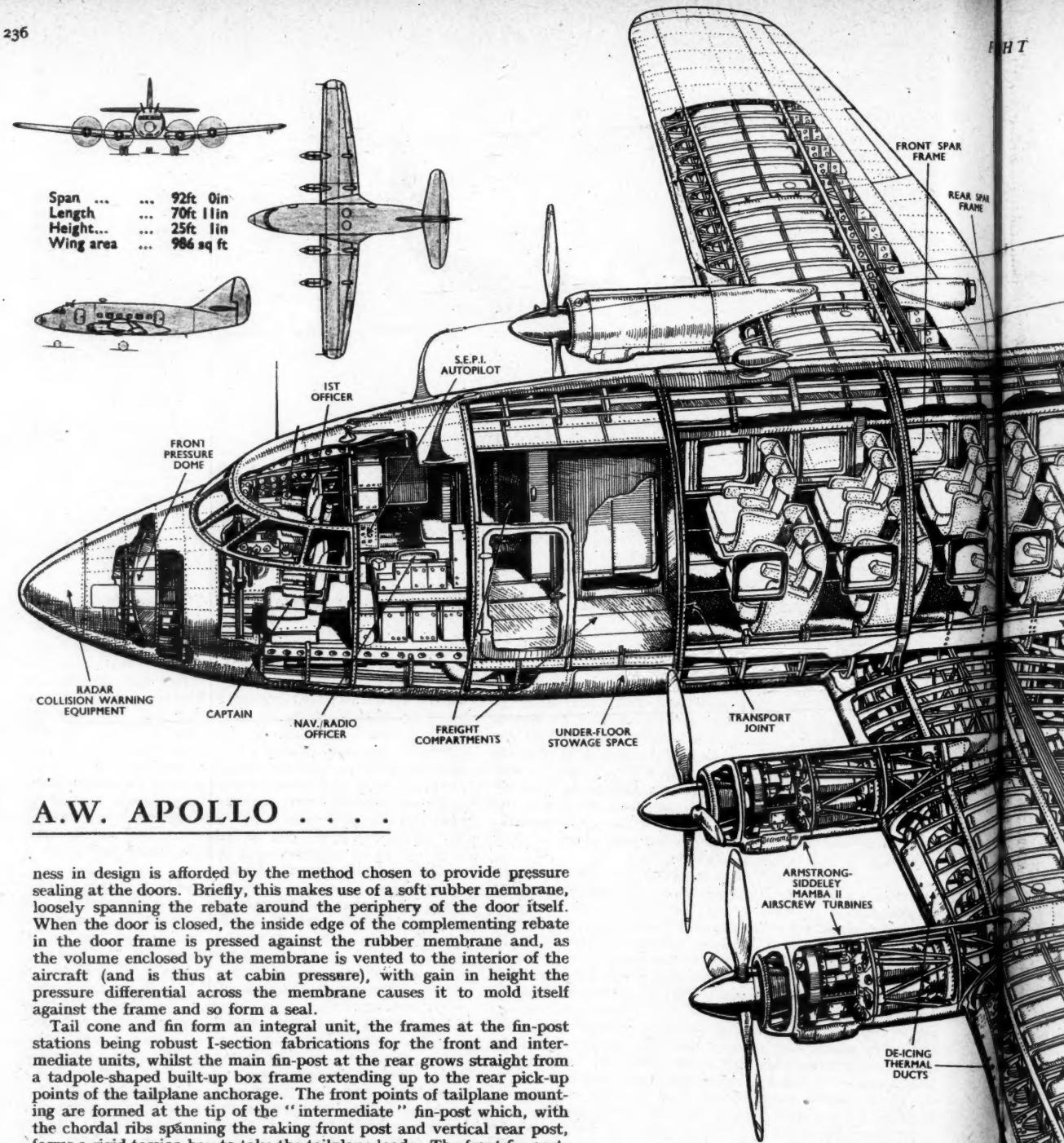
Although the general layout of the aircraft conforms to the orthodox concept of a modern low-wing design, the use of turboprops and Fowler flaps called forth some measure of design ingenuity in the main undercarriage geometry and flap actuation. The small diameter of the Mamba power units makes it impossible to retract the undercarriage into the nacelles in the time-honoured fashion, quite apart from the intransigence of the jet pipe. Additionally, the moderately thin wing also affords little stowage space for wheels and legs of the size required. The only alternative was to retract sideways in the fighter manner. Unfortunately, the spanwise location of the undercarriage legs when retracted meant that straightforward support and actuation of the Fowler flaps was obstructed, and in order to overcome this, a system was devised using swinging links for flap articulation.

There is nothing very unusual in the detail design of the fuselage, although the use of alternating wide and narrow frames is not standard practice. The frames are alike in being of rolled channel-section form but, whereas the narrow channels ride on the free flanges of the Z-section stringers, the wide channels are notched for stringer passage, attachment between stringers and frames being by direct riveting and through the medium of shear cleats. Built in three sections, with transport joints formed by abutting extruded rings bolted through their free flanges, the fuselage is of circular section almost throughout and, longitudinally, incorporates a parallel trunk 10ft 2 in in diameter and about 18ft in length.

To bridge the cut-out in the belly of the fuselage necessitated by having to accommodate the undercarriage and centre-section flap, resort has been made to massive extruded longerons at floor level to compensate the loss in rigidity under bending load caused by the cut-out. Throughout the cabin the floor is at one level, but forward of the bulkhead dividing the flight deck from the rearward accommodation, the floor is raised about 4in above the general level. Lateral channel-section beams are used, together with Z-section intercostals, to form a grid framework supporting the floor panelling, the floor as a whole being stressed to cope with a loading of 50 lb/sq ft.

At the main- and front-spar stations, wing/fuselage union is made through massive fork-and-lug forgings, the fuselage units of which are so designed as to form integral parts of the massive built-up frames at these stations. The front spar-frame is of I-section, whilst the main spar-frame is of box form, both frames employing heavy-gauge extruded L-section "booms" and plate webs and flanges. For a pressure differential of 5½ lb/sq in, the window area is generous (about 18in by 15in) whilst the method of glazing is as clever as it is novel. Dry air sandwich-type windows are used, the outer panes being approximately ¼in Perspex whilst the inner panes are about ⅛in thick with a ⅛in-wide cavity between. The panes are carried in double-channel frames of extruded rubber which are clamped securely in position by diagonal drawbolts; two windows on each side are formed as escape hatches.

Like the structural framing of the windows, that to the doors is also built-up with press-formed members although, naturally, of heavier gauge. Another example of fresh-



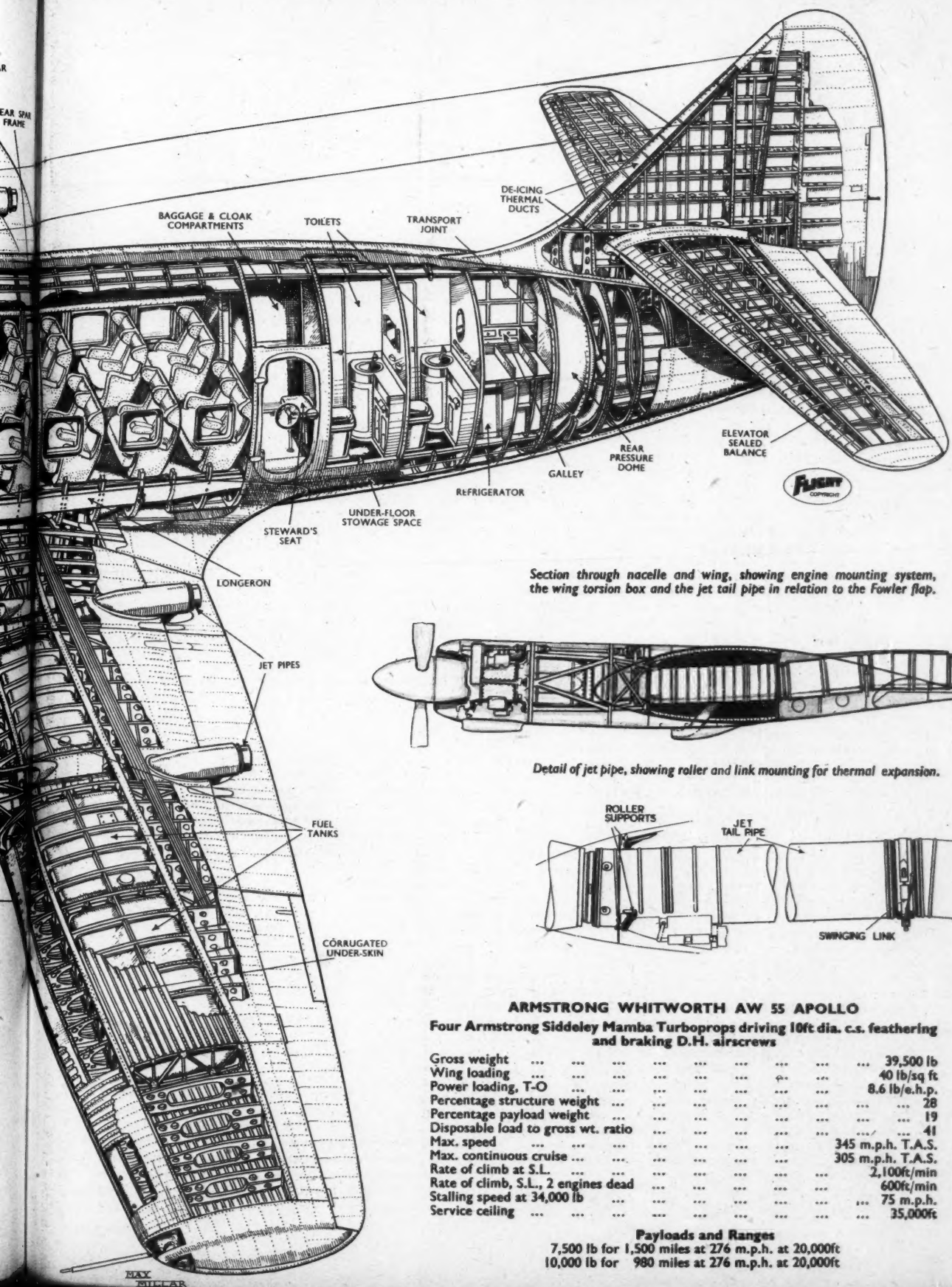
A.W. APOLLO . . . .

ness in design is afforded by the method chosen to provide pressure sealing at the doors. Briefly, this makes use of a soft rubber membrane, loosely spanning the rebate around the periphery of the door itself. When the door is closed, the inside edge of the complementing rebate in the door frame is pressed against the rubber membrane and, as the volume enclosed by the membrane is vented to the interior of the aircraft (and is thus at cabin pressure), with gain in height the pressure differential across the membrane causes it to mold itself against the frame and so form a seal.

Tail cone and fin form an integral unit, the frames at the fin-post stations being robust I-section fabrications for the front and intermediate units, whilst the main fin-post at the rear grows straight from a tadpole-shaped built-up box frame extending up to the rear pick-up points of the tailplane anchorage. The front points of tailplane mounting are formed at the tip of the "intermediate" fin-post which, with the chordal ribs spanning the raking front post and vertical rear post, forms a rigid torsion box to take the tailplane loads. The front fin-post, which rakes at 45 deg., stops at tailplane level and is joined to the front frame continuum with forged end-fittings. Pressed sheet chordal ribs and vertical stringers of top-hat section form the skeleton structure on which the fin is skinned, whilst built-up box ribs extend rearward of the main fin-post to carry the rudder shroud and hinge brackets.

The tailplane is built with a straight-through main spar of plate web type, using extruded angle booms only over the central quarter of its span: from there outboard the edges of the plate web are turned over to form flanges. The front spar is swept back at 10 deg. and is of similar construction. Inter-spar chordal ribs are pressed-sheet units notched for the top-hat stringers stabilizing the skin, but in way of the elevator hinges, on the tailplane centre-line, and in way of the fuselage/fin pick-up points, the ribs are additionally Warren-braced with rolled square-section tubes. Aft of the rear spar, the skin is

IN addition to showing the skeletal construction of the Apollo, together with the accommodation layout for 24 passengers, our chief artist Max Millar, has also skilfully portrayed the graceful proportions of this extremely attractive new aircraft. The disposition of the jet tail pipes and the plane of rotation of the airscrews relative to the cabin, should, with the wall insulation employed, go to make the Apollo a very quiet aircraft.



Section through nacelle and wing, showing engine mounting system, the wing torsion box and the jet tail pipe in relation to the Fowler flap.

Detail of jet pipe, showing roller and link mounting for thermal expansion.

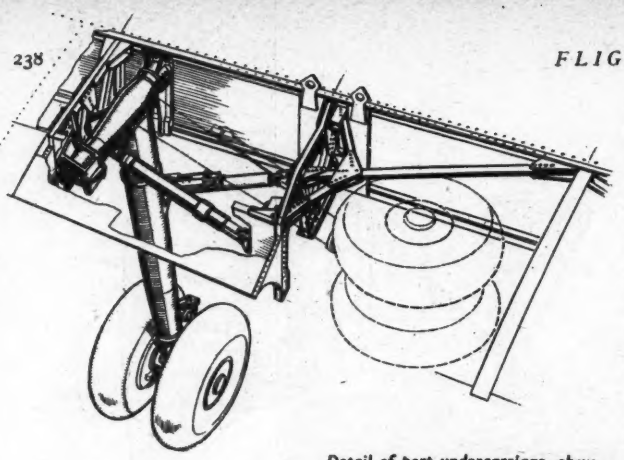
ARMSTRONG WHITWORTH AW 55 APOLLO

Four Armstrong Siddeley Mamba Turboprops driving 10ft dia. c.s. feathering and braking D.H. airscrews

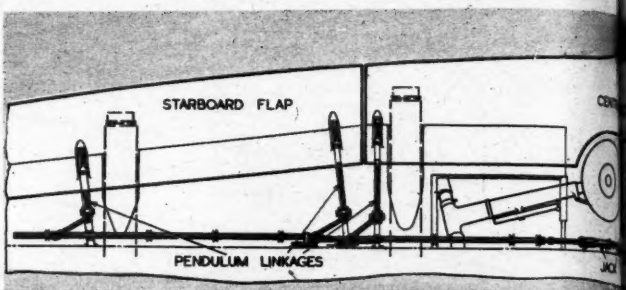
Gross weight	39,500 lb
Wing loading	40 lb/sq ft
Power loading, T-O	8.6 lb/e.h.p.
Percentage structure weight	28
Percentage payload weight	19
Disposable load to gross wt. ratio	41
Max. speed	345 m.p.h. T.A.S.
Max. continuous cruise	305 m.p.h. T.A.S.
Rate of climb at S.L.	2,100ft/min
Rate of climb, S.L., 2 engines dead	600ft/min
Stalling speed at 34,000 lb	75 m.p.h.
Service ceiling	35,000ft

Payloads and Ranges

7,500 lb for 1,500 miles at 276 m.p.h. at 20,000ft
10,000 lb for 980 miles at 276 m.p.h. at 20,000ft



Detail of port undercarriage, showing mounting, actuating and bracing structure and retraction geometry.



Plan diagram of undercarriage retraction well in the centre-section, the flap actuating transmission for centre-section and starboard

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carried rearward on cantilever members to form the sealed balance chamber for the elevator nose shroud. There are five hinges carrying the elevator, the hinge brackets being housed in doubled, box-form ribs.

The elevator has a channel spar which forms the web of the D-box leading edge. Projecting forward from the centre of the D-box is a spine blade to which is secured a rubberised-fabric membrane, the leading edge of which is attached to the wall of the shroud recess; by this means, the shroud volume is laterally divided into upper and lower balance chambers. Chordal ribs are roughly at 10 in pitch and are pressed channel diaphragms with the skin plating riveted direct to their flanges. The elevator tabs serve both as trimming and servo surfaces and are jointly operated by double screw-jacks working through a toggle linkage. The servo balancing function of the tab is arranged by the juxtaposition of the pivot centres in the toggle linkage relative to the hinge axis of the elevator proper, whilst for its function as a trimming surface, the tab is actuated by the uppermost of the two jacks. The lower jack is only brought into action during the landing procedure: when the flaps are lowered, automatic actuation of the jack takes place to operate the tab and so move the elevator in order to neutralize the pitching moment introduced by flap lowering. This control refinement strikes us as being a very useful aid. Automaticity can easily be overdone, but the pilot of a modern multi-engined aircraft has more than enough to do during let-down procedure and any reasonable means of alleviating the burden of his worries is worthwhile.

Wing Design Details

In structural form the rudder is identical with the elevator, with the exception that the sealed balance is replaced by a conventional horn balance of roughly half the rudder height. As with the elevator, mass balancing takes the form of lead strips in the leading edge nose. The rudder is swung on three hinges, all incorporating self-aligning ball bearings, and the large area tab serves both for trimming and servo balancing. As already discussed, the use of the patent AW corrector rudder, in which the surface is vertically divided into fore and aft units, respectively actuated hydraulically and mechanically, will not be used for the prototype's initial flight trials.

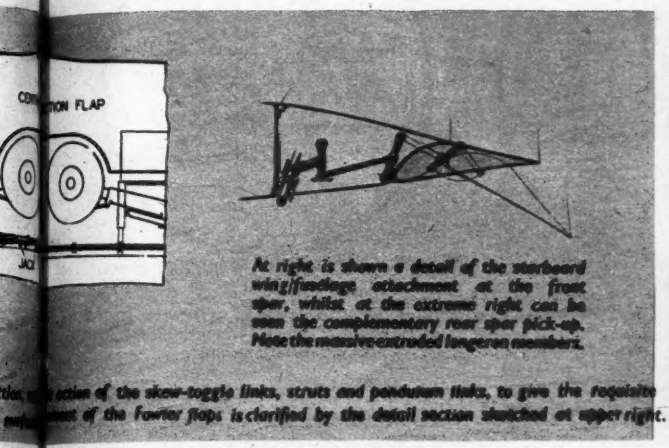
By far the most complicated structural part of the Apollo is the wing centre-section, this being chiefly due to the undercarriage and flap arrangement and the resulting necessity to employ extremely robust scantlings. In particular, the spars are immensely strong diaphragm members with taper-machined extruded booms and heavy-gauge plate webs stabilized with top-hat-section verticals. In way of the inboard engines, the ends of the centre-section spars employ a lozenge trussing to brace the booms in order to allow passage of the jet pipe. Provision has been made in the centre-section for the incorporation of supplementary fuel tanks for extra long range, if required, the inter-spar volume being divided into four bays by Warren-braced chordal ribs. Between the full ribs, the wing skinning panels are supported on built-up box-section contour members bridging the cells, and it is here relevant to dilate somewhat upon the type of skinning employed in the Apollo wing.

Rigidity in torsion has always been a primary design element in wing structure, and the ease with which this quality can be imposed can, for a given structure weight, be said to be directly related to aspect ratio and thickness-chord ratio, it being considerably less difficult to make a thick wing of low aspect ratio torsionally stiff than is the case with a thin wing of high aspect ratio. The Apollo wing, although not of extreme form, is fairly thin and of fairly high aspect ratio: it is an 18 per cent t/c section and the aspect ratio is 8.6. Rather than employ huge spar booms and a multiplicity of inter-spar ribs Mr. John Lloyd and his design team decided to distribute some of the mass of the spar booms into the skin. By so doing, a rigid panelling bridging the spars is obtained which, in virtue of its self-sufficient strength, also dispenses with much of the supporting rib work otherwise necessary.

The increase in material devoted to skinning by this course has not, however, been put into the actual skin surface itself. This is of conventional gauge. The "transferred" material has gone to the fashioning of an inner skin made up of individual opened top-hat-section spanwise stringers, close-spaced with their flanges overlapping and through-riveted to the skin plating itself, in order to provide an integral corrugated supporting structure. The torsion-box skinning in the centre-section is in four sub-assembled panels—two upper and two lower—the latter pair actually being formed as access doors to the tank cells, although we might reiterate that the installation of tanks in the centre-section is only a special case.

Extending rearward off the main centre-section spar are paired chordal trusses, port and starboard, spaced about 5 ft apart, the outboard members lining up with the inboard bounding rib of the engine mounting emplacement. These trusses, united by a subsidiary "spar" about 2 ft 9 in aft of the main spar, serve to take the main undercarriage loads, the cross-head tube on which the leg is mounted being pivoted in forged bearing housings at the outboard rear corner of the "box" and on the rear face of the main spar, the leg, when retracted, lying diagonally across the box.

As already noted, the obstruction caused by the retracted undercarriage has incurred the necessity for an unorthodox method of articulating the Fowler flaps. There are three flap units, one of full centre-section span, and port and starboard surfaces on the outer wing panels, all three being supported and actuated in a similar fashion. Just to starboard of the aircraft's centre-line on the face of the rear spar is carried a double-acting hydraulic jack, with push-pull rod extensions along the spar face to port and starboard. Yoke-pivoted radius struts transfer the spanwise motion of the push-pull rod to give fore-and-aft swing



At right is shown a detail of the starboard wing/fuselage attachment at the front spar, whilst at the extreme right can be seen the complementary rear spar pick-up. Note the massive extruded longeron members.

...action of the skew-toggle links, struts and pendulum links, to give the requisite ...ment of the Fowler flaps is clarified by the detail section sketched at upper right.

motion to pendulum links, the feet of which are pinned to transfer struts giving similar motion to the links carrying the flap itself. These supporting links are also pendular, and the arrangement of their pivot centres is such that in moving the flap down they also carry it rearwards in conformity with Mr. Fowler's theories. All the pivot bearings in the flap linkage are of self-aligning ball type, so that static friction in the system is low. The flap surfaces are of 30 per cent wing chord and extend over approximately 60 per cent of the span, to give a percentage increase of area in the region of 6½.

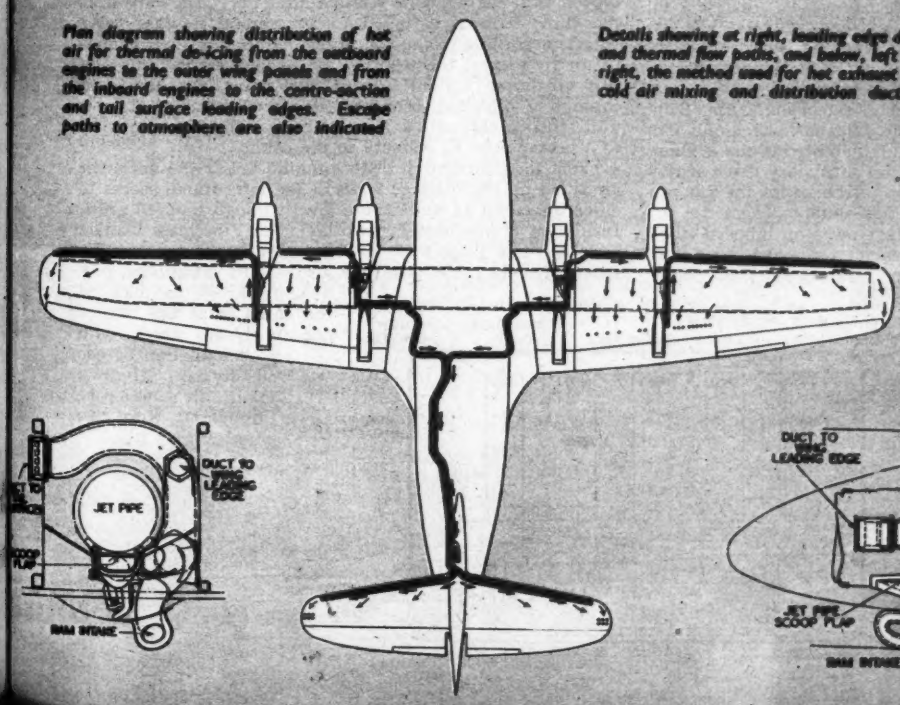
The ends of the centre-section spar booms are finished with forged end-fittings for the horizontal pin joints with which the outer wing panels are attached. Only the outer wings are given dihedral, the angle measured to datum being 6 deg. The aerofoil used is an N.P.L. section, with a designed least-drag C_L of 0.3. Maximum thickness is at the 40 per cent chord ordinate, and it is justifiable to assess the section as being of mildly laminar-flow type. The description already given for the spar torsion box structure used in the centre-section applies equally for the outer wing panels, but, whereas in the former, the inter-spar volume is available for fuel tankage only if particularly required, in the outer wing this volume is given over to the accommodation of three tanks port and starboard, which extend to within about 10 ft of each wing tip. Aft of the rear spar, pressed sheet ribs carry the skin over the flaps and ailerons, although the profile is altered appropriately to give a "roof" over the flaps and to form the sealed balance chamber for the ailerons in a similar fashion to that already described for the elevators. In this connection, the structure of ailerons and elevators is precisely similar.

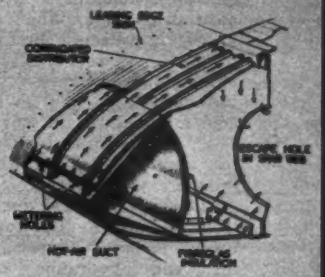
When dealing with the empennage, we puposely omitted reference to the leading edges of the fixed surfaces, because in structure they are similar to that employed on the wings, and we deemed it advisable to leave a structural issue unconfused with the subject of de-icing, a matter which can more appropriately be dealt with here. In the actual structure of the leading-edge thermal duct, there is nothing very new, but novelty is introduced into the system by using the jet exhaust gases as the heat source. The outboard engines serve the outer wing leading edges, whereas the inboard engines serve the leading edges of the centre-section, tailplane and fin. An electrically actuated thermostatically-controlled flap-valve in the jet pipe deflects part of the exhaust flow into a duct leading to a mixing chamber in which ram air is also introduced from a scoop in the wing

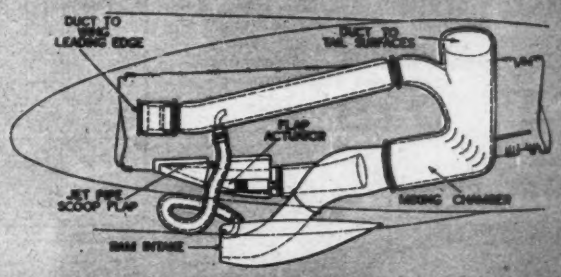
The temperature of the gases abstracted from the jet pipe

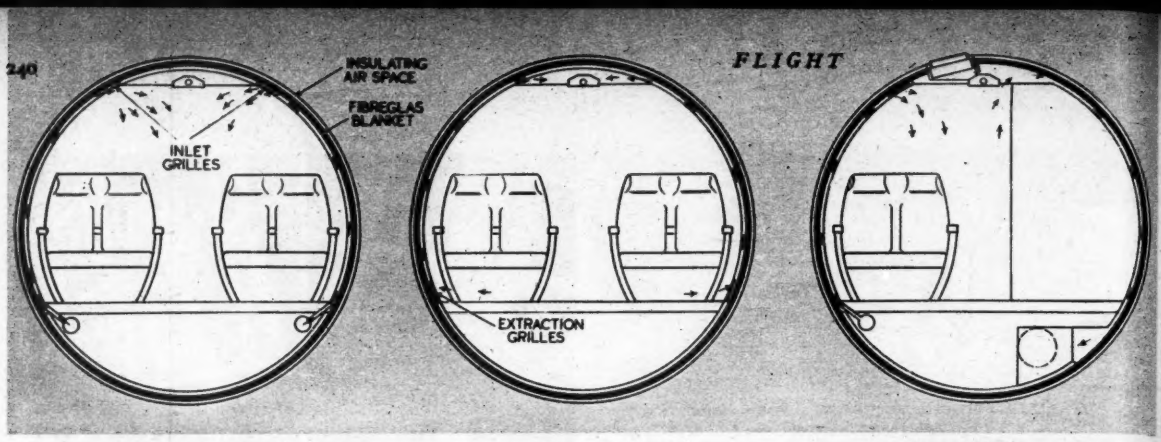
Plan diagram showing distribution of hot air for thermal de-icing from the outboard engines to the outer wing panels and from the inboard engines to the centre-section and tail surface leading edges. Escape paths to atmosphere are also indicated

Details showing at right, leading edge duct, and thermal flow paths, and below, left and right, the method used for hot exhaust and cold air mixing and distribution ducting.



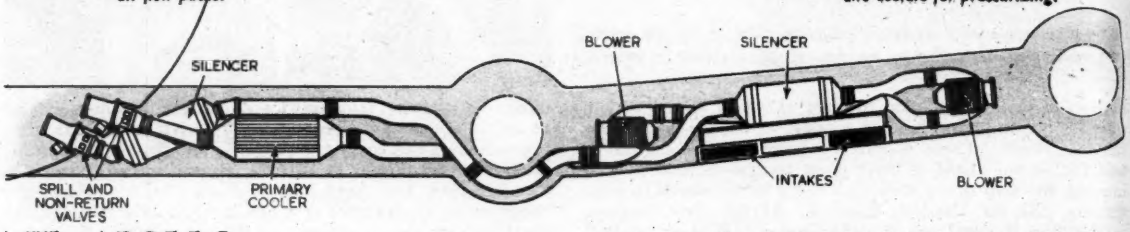






Above : typical sections through cabin, showing fresh air, exhaust, and recirculated air flow paths.

Below ; port wing leading-edge, showing arrangement of intakes, blowers, silencers and coolers for pressurizing.



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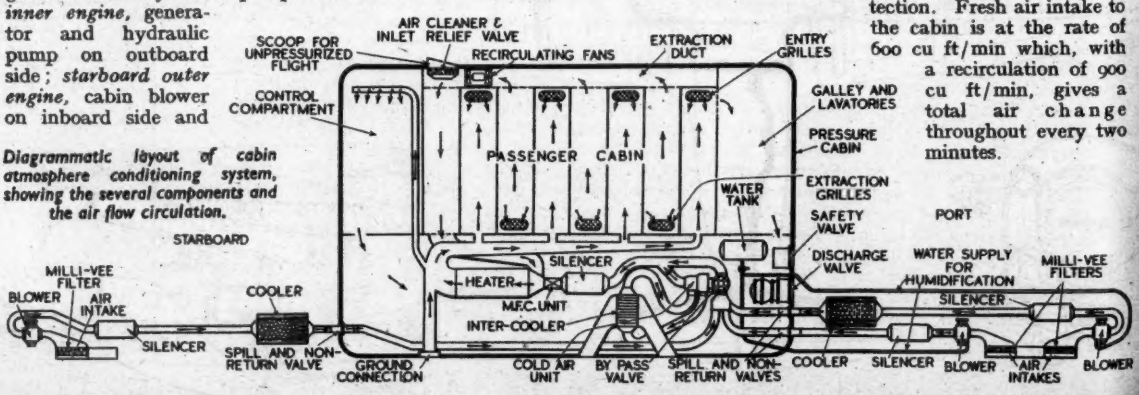
is of the order of 400 deg C, which, of course, is very much above that required for de-icing, and it is for this reason that cold air is introduced, the thermostat being employed to hold the temperature of the mix at somewhere between 150 and 170 deg C. From the mixing chamber, the hot gases are directed to the leading-edge ducts, where they issue through metering holes and flow through the chordal passages of a corrugated director shroud against the interior surfaces of the leading-edge skinning, to escape through apertures in the front spar, flow through the wing and then finally exhaust to atmosphere. The discharge to atmosphere in the tail surfaces is made through holes at the tips. These thermal ducts for de-icing are furnished to 57 per cent of the wing span, 80 per cent of the tailplane span and about 70 per cent of the fin height.

The Apollo's power installation is straightforward and simple. From the four pick-up points on the firewall of each Mamba, tubular steel struts with diagonal bracing extend back to the booms of the front spar, attaching to these with forged h.t.s. gusset-plate end-fittings. The jet exhaust is conducted through the wing and is carried up to eject over the trailing edge through a tail pipe; this is located in rollers at the front and in swing links at the rear in order to accommodate thermal expansion. On each Mamba, an auxiliary drive shaft extends back along the top of the engine to a bevel gearbox mounted in the leading edge above the main spar, and with subsidiary drive shafts sloping down on each side to unit gearboxes for the mounting and drive of various auxiliary units. These are as follows: *port outer engine*, cabin blower on inboard side; *port inner engine*, cabin blower on outboard side, and generator and hydraulic pump on inboard side; *starboard inner engine*, generator and hydraulic pump on outboard side; *starboard outer engine*, cabin blower on inboard side and generator on outboard side. The cabin blowers are Marshall 15 lb/min units, the hydraulic pumps are Lockheed Mk. VI units, whilst the generators are Rotax 6 kW units. The engine cowlings rearward of the compressor delivery station are aircraft parts and are arranged in upper and lower pairs, hinged along ridge and keel and secured with Napier flush toggle-action fasteners.

In its pressurization and cabin atmosphere control installation, the Apollo conforms to accepted practice, but it has the additional refinement of a cold-air unit incorporated in the circuit to effect air-drying in conditions of high ambient relative humidity. Each of the Roots-type cabin blowers has an individual Milli-Vee filter air intake and delivers through individual silencers. The blowers on the outboard engines feed through primary air-to-air inter-coolers, and only the blowers on the port engines are supplied with water for humidifying. This latter quality is in line with the latest ideas on this subject and, briefly, embraces the supply of water to the interior of the blower, the action of which finely atomizes the water, so that the air delivered by the blower is at the requisite relative humidity. Delivery from the three blowers is taken to a common by-pass valve which, according to the conditions required, either delivers to, or by-passes, the Godfrey air turbine refrigerator unit (for air-drying action). From this point, the airflow is through a combined secondary silencer and water-separator unit, thence through a Normalair mass-flow control unit to a heater prior to delivery to the cabin.

From the distribution ducts running below the floor, the air is led up the fuselage walls in the inter-frame spaces to enter the cabin at wall-ceiling level through louvred grills. Insulation is provided by two layers of Fibreglass blanket over the free flanges of the stringers, whilst the free air spaces between the stringers also afford additional protection. Fresh air intake to the cabin is at the rate of 600 cu ft/min which, with a recirculation of 900 cu ft/min, gives a total air change throughout every two minutes.



Diagrammatic layout of cabin atmosphere conditioning system, showing the several components and the air flow circulation.

Photographs taken at Nchanga during the air rally include a general view with a Bonanza in the foreground, a Piper Cub and a Harvard in flight, and a Gemini viewed from the cockpit of a Lancaster. Part of the African audience made use of a natural grandstand. A Bristol New Type 170 Freighter, on its delivery flight to Central African Airways, dropped in during the event and created much interest.

RHODESIAN AIR RALLY

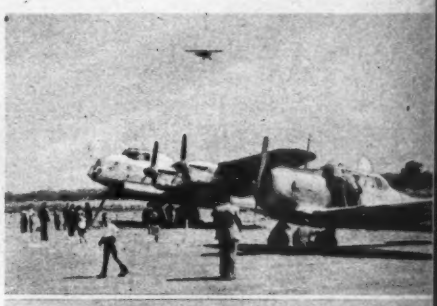
THE Flying Club of Northern Rhodesia held its first big air rally at Nchanga Airport, Chingola, on July 31st and August 1st. Visiting aircraft came from Kenya, Southern Rhodesia and many parts of Northern Rhodesia, and joined in making the rally successful in every way. This report on these events has been sent to *Flight* by the Director of Information, and the photographs were taken by Mr. N. J. V. Watt, of his Department.

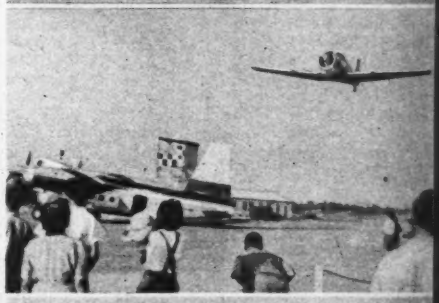
A Government Gemini flown by the Director of Civil Aviation, Colonel Muspratt Williams, led another Gemini, also from Lusaka, the capital of N. Rhodesia, in demonstrations of formation flying that were greatly appreciated by the spectators. The aerobatic display given by F/L. Caldwell in an R.A.F. Harvard from Southern Rhodesia was superb, and his demonstrations of loops, rolls and inverted flying were received with enthusiasm by Africans and Europeans alike. An R.A.F. Lancaster from Kenya was inspected with interest by members of the general public and certainly by every child present. Later it gave an impressive display of flying, with one and two engines feathered.

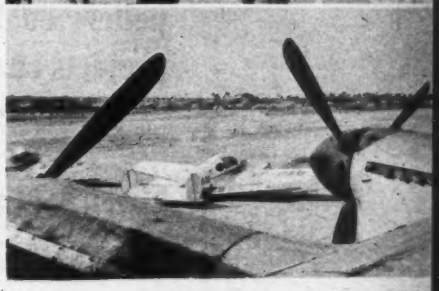
A Bristol New Type 170 on its delivery flight to Central African Airways stopped at Nchanga Airfield and was the centre of much interest. A Bonanza was used to give joy-rides to the public, and Piper Cubs, flown by members of the Flying Club, gave a very good show in the competitive events of the rally, which included spot-landing, bombing, streamer-cutting competitions, etc. Mrs. Muspratt Williams presented the prizes and the cup won by the Nkana Group.

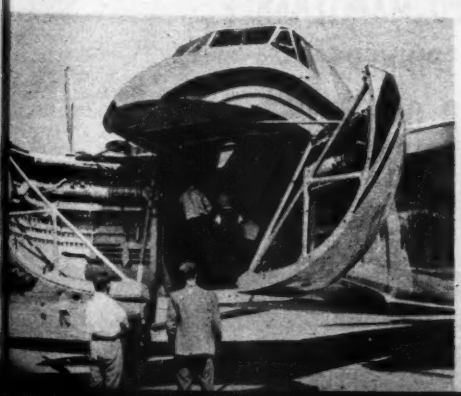
The Flying Club of Northern Rhodesia has been in existence for seventeen years. It started in Lusaka with twenty members and a Tiger Moth, which was presented by Lord Wakefield. Now the Club is centred in the Copperbelt with branches at Chingola, Nkana, Ndola, Luanshya and Mufulira. It has a strength of 120 members, of which over half learnt to fly through the Club.

Until 1939 the Club was active, but shut down at the outbreak of war, when the Tiger Moth was sold to the R.A.F. for training purposes. The Flying Club reopened, however, in 1946, and bought three second-hand Tiger Moths. It was soon found that the Club could not be financially independent, and the Committee was forced to sell the remaining aircraft, and the Club again closed down. Messrs. Thatcher and Hobson of Northern Rhodesia became interested, and the Flying Club was restarted, Thatcher and Hobson supplying the aircraft and members buying their flying. The aircraft now being used are Piper Cubs. The aim of the Club is to promote civil flying within the territory, and it is succeeding remarkably well, with membership increasing each year as more people take advantage of the opportunities and fine conditions available.



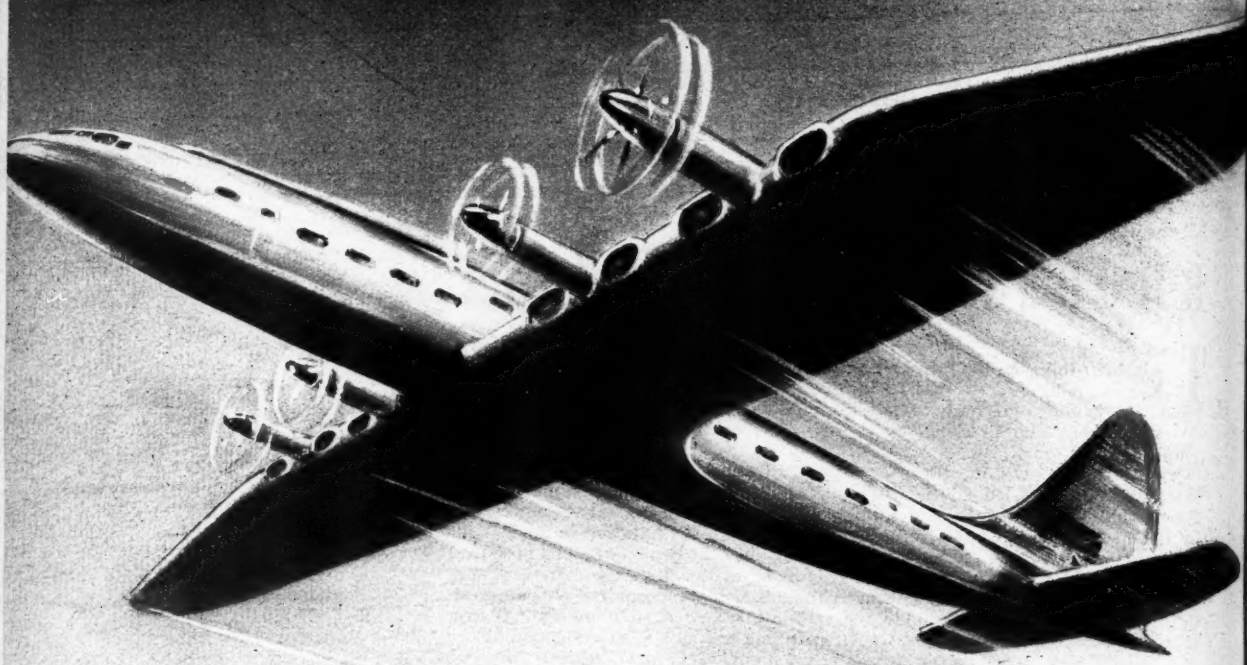






ROTOL

PROGRESS IN PROPELLER DESIGN



Constant research into the design of aircraft propellers enables Rotol to include in their advanced projects characteristics which will become essential features of the modern aircraft propeller.

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- FLUID OR ELECTRIC DE-ICING
- LOW NOISE LEVEL
- DEPENDABLE PITCH REVERSAL
- REDUCTION IN WEIGHT
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- DUCTED SPINNERS
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ROTOL LIMITED · GLOUCESTER · ENGLAND

Swedish Visitor

Scandia Seen for the First Time in England

Spacious twenty-four seat layout of the Scandia. A complete description of the aircraft's structure and equipment, and an appreciation from the pilot's viewpoint appeared in the June 3 issue of "Flight."

AFTER several days in Dublin, demonstrating to officials of Aer Lingus, the Saab Scandia first touched down in the United Kingdom at Prestwick. Further demonstrations were given to aviation circles in Scotland, and after a short stop at Silloth, near Carlisle, the new Scandinavian prototype feeder-line transport landed at Gatwick on August 20th. After a preliminary look-over, two flights were made by M.C.A. officials and airline representatives, and of the 40-odd passengers who flew in it for the first time, not one was lacking in appreciation of the performance and comfort of the aircraft.

In outward appearance, this DC3 replacement is modern but conventional. Ease of manœuvring on the ground with the steerable nose-wheel was apparent as the aircraft was brought in to park in front of the passenger building. Spectators were surprised to see, as the aircraft was stopped, a telescopic strut at the tail extend itself vertically until it touched the ground. This tail prop locks down and holds the aircraft in the correct horizontal attitude to prevent any mishap due to overloading aft.

For the passenger, the inside of the Scandia is comfortable and the colour scheme in this demonstration aircraft, with green cloth seats, brown leather armrests and a beige ceiling, is very pleasing. This particular version accommodates 24 passengers with ample leg room, and a wide gangway. Each passenger has a good view through reasonably large windows, and the noise level in flight throughout the aircraft was unusually low. Skylights along the roof relieve the gloom too often experienced in aircraft when unlighted.

Flight impressions for the passenger were that after a short run the climb was steep but without apparent exertion; in fact, during the take-off the noise in the passenger cabin was such that normal conversation could be carried on. Manœuvrability with wheels and flaps down was demonstrated in what might be considered a bad-weather landing. The aircraft was brought in close to the airfield and was landed without fuss after two S-turns and a steep descent. The engines are Pratt and Whitney R.2000 giving 1,450 h.p. The Scandia is therefore under-powered at present, since it was designed for two of the later Pratt and Whitney E-12, R.2130 engines which give 1,650 b.h.p. dry and 1,800 b.h.p. with water injection. This would permit the aircraft to operate at a greater altitude, for which pressurization of the fuselage would be included. It has also been suggested that in order to overcome dollar difficulties in Commonwealth and European countries Rolls-Royce Merlin powerplants might well be fitted. They have several advantages in that many years of development now lie behind them, the initial cost would be moderate and spares and servicing are assured for some years to come.

On Monday of this week the Saab Scandia was demonstrated to officials of the British corporations at Northolt. After returning to Sweden for a short period protracted tours of the Continent and South American countries are planned.

LONDON AIRPORT CONSTRUCTION

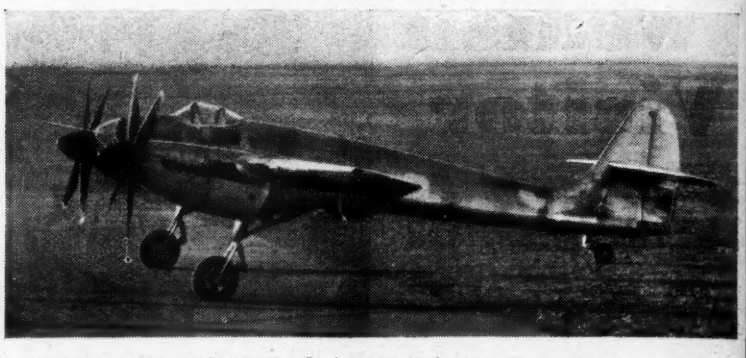
THE report from the Select Committee on Estimates for the construction of London Airport has been published. With reference to the runways and terminal buildings it was stated that the present temporary terminal buildings would be superseded by semi-permanent buildings in the central area. They would be of a two-storey, pre-fabricated type, and would not interfere with the permanent buildings which would be erected later. Work should begin at the end of this year and the buildings should be ready for use by 1950 with a life of about ten years. Reasons for making semi-permanent buildings were that more experience over the requirements for a major civil airport were needed and, secondly, that interim construction could be completed more quickly. Access to the central area, said the report, would be by a shallow tunnel leading from the present Bath Road. The tunnel would contain two 22-foot carriageways and two 15-foot cycle tracks. Since the excavation would require removal of a section of one runway, it would be necessary to complete a parallel runway before work on the tunnel could begin.

Construction of the last three runways on the north side of the Bath Road under Stage III of the project involved diverting the road some distance to the north, and it was agreed that as alternative accommodation would have first to be provided for the occupants of houses demolished, the runways could not be completed for a number of years.

The estimated traffic capacity at various stages was considered to be optimistic, and the Ministry now considered the maximum traffic possible at Stage II, with six runways, would be 72 movements per hour instead of 90-100. It was anticipated, therefore, that some air services may have to be refused as there would not be a diversionary airport with adequate terminal buildings to relieve Heathrow. The total cost of development of the airport was shown in the Estimates at a provisional figure of £26,000,000. Of this, some £6,583,000 had already been spent, and £1,588,000 was estimated to be spent this year. To complete the work south of the Bath Road, a further sum of about £15,000,000 was required, including over £6,000,000 for the development of the No. 1 Maintenance Area and £4,000,000 for the terminal buildings. The work to be done north of the Bath Road, to complete Stage III of the scheme, would cost £3,000,000. There has been a slowing down in the construction programme as a result of the general policy of restricting capital investments.

In conclusion, the Committee considered that the choice of Heathrow as the site for London's major civil airport was well made. The effect of restrictions on capital construction was likely to be serious, since the completion of Stage II was already thought to be inadequate to meet traffic demands, and any delay in progress would only make that possibility more uncertain. Provision of maintenance facilities was important to the British corporations, which estimated a saving of £1,000,000 a year if all aircraft were based at London Airport. The Committee recommended that a programme in accordance with the reduced resources available should be worked out. The programme should allow maximum application of labour and materials to work on the completion of maintenance areas and hangars, in order that the corporations might be accommodated at the airport as soon as possible. In fact, it was recommended that the reduced constructional programme should again be reviewed with a view to possible acceleration.

HERE AND THERE



MERLINS IN THE ARGENTINE: Produced by the Argentine Secretaria de Aerotecnica, the "Nancu" twin-engined interceptor and night-fighter is powered by Rolls-Royce Merlin engines, as reported in "Flight," July 29th. In this photograph a superficial resemblance to the D.H. Hornet is apparent.

Oslo Air Week

ON September 6th, the opening day of the Norwegian Aero Club's Air Week, American Fortresses are expected to visit Oslo. An R.A.F. Squadron has been promised for formation and aerobatic flying displays and Capt. Spikes will perform with his Piper Cub. There will also be a helicopter demonstration.

Jets Returning Home

AFTER three weeks in Europe, during which they completed over 40,000 miles on training and demonstration flights, the American Shooting Star fighters took off from Odiham on August 17th on the first stage of their return flight to the U.S.A. They will return via Iceland and Labrador and expect to meet the British Vampires, which are now on their way back from the U.S. on the route. Like the Vampires, the Shooting Stars have been delayed by bad weather for several days prior to making the east and west crossing.

Beryl-Meteor

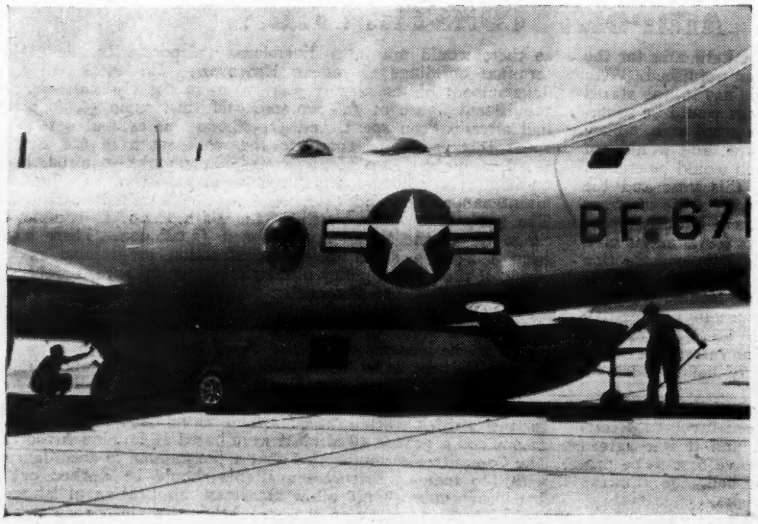
IT is now confirmed that the Gloster Meteor fitted with two Metrovick Beryl axial flow gas turbines, similar to the engines of the Saunders Roe SR/A1 fighter flying boat, will take part in the flying display at the S.B.A.C. show at Farnborough from September 7th to 11th. It has also been announced that a Titanine service van will be available during the week to the industry for touching up and carrying out paint repairs to aircraft; demonstrators will be present to operate the spraying equipment for the interest of visitors besides the requirements of the exhibitors.

Radiography at Northolt

B.E.A. employees at Northolt Airport will be able to have free X-ray examinations in September when the Mass Radiography Unit of the Middlesex County Council is installed on September 6th for a period of three weeks. With Dr. Pointon-Dick in charge the unit will be able to handle 3,600 persons, with two days a week being set aside for checking any doubtful cases. Employees of other organizations in the Northolt area will be accepted for voluntary examination. Statistics reveal that cases of tuberculosis detected in their very early and curable stages average about four persons per thousand of those examined.

Effects of Supplying Berlin

DURING the first week of August, 476,000 pounds of cargo were flown between Frankfurt and Berlin by American Overseas Airlines. In co-operation with the U.S. Air Force's Berlin operations A.O.A. have increased their scheduled flights on this service from six to 25 round trips a week. The supplying of Berlin by air is beginning to have an effect on freight being brought to England by air. Freight charter companies are finding an acute lack of aircraft for domestic use and foreign freight companies are now getting the orders. According to Airports, Ltd., Gatwick, over 10 tons of Camembert cheese arrived on August 17 in three French Dakotas. Air Transport Charter (C.I.) normally operate three DC-3s but are having to use Rapides between Gatwick and Jersey as one DC-3 is on the Berlin lift service and the other two are being used on the "Milk-run" from Ireland to Speke.



AMERICAN A.S.R.: An A-3 airborne lifeboat of the U.S.A.F., built by the Edo Corporation of New York, being placed in position beneath the fuselage of a B-29. The beaching gear is quickly detachable and is useful for handling on the ground, permitting speeds of 40 m.p.h. to be used.

Models at Radlett

OVER 3,000 visitors attended the model aircraft rally held at Radlett on August 22nd by the St. Albans Model Aero Club. The attempt of Mr. A. E. Jaggers to capture the world's speed record for model aircraft, which was to have been made on this occasion, was cancelled, and the fastest speed recorded at the rally was put up by Lt. J. W. Hedges, of South Africa, whose model exceeded 105 m.p.h. Mr. Jaggers hopes to fly a twin jet model across the channel within the next few months. The open rubber duration test was won by Mr. Peck, of St. Albans, and the duration test for powered models was won by Mr. Marcus, of Croydon. For the second year in succession Mr. S. Miller, of Luton, won the Concours d'Elegance.

Vampire from Russian Zone

THE pilot of the R.A.F. Vampire which force-landed in the Soviet zone of Germany on August 16th, returned to his station near Leubeck on August 22nd, and later reported to H.Q., B.A.F.O., at Bueckeburg. His aircraft was returned on a lorry.

A New Auster

FURTHER details are now available of the Auster A2/45, a brief description of which appeared in *Flight*, August 19th. Attention has been paid to accessibility and ease of maintenance in the field, important for an Army Air Observation Post aircraft; instruments, rudder pedals and all the structure forward of

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the door is accessible through large panels on each side of the machine, which can be removed without tools. The under-fairing beneath the fuselage can be removed by unlocking a spring-loaded bolt. Dismantling of the wings has been made as easy as possible, and again can be carried out without the use of any tools, and this applies also to the engine and cowlings which can be removed in four pieces. For operating in and out of confined spaces large split flaps are fitted and further lift is obtained by drooping ailerons, the droop taking place with the initial movement of the flaps. Wing-tip slots have been provided to keep the ailerons "alive" at low speeds, and the combination of these features results in very satisfactory handling qualities.

Officers' Club in Sydney

EX-OFFICERS of the Royal Australian Air Force have formed an Air Force Officers' Club in Sydney and have suitable club premises under negotiation. It is intended to form a link with other clubs of a similar nature in Allied countries. The club's membership already totals 300, and applications are being dealt with at the rate of 30 at each committee meeting.

Keeping On Time

A NEW rating device for navigational watches has been installed in the K.L.M. Instrument, Electrical and Wireless Section of Schiphol airport. Of American manufacture, this new instrument is known as the Timeograph. Watches which require checking are suspended on a spring near a microphone, and the tick of the watch is amplified and electrically recorded on a calibrated strip of paper, each tick being indicated as two distinct and even sounds. Irregularities in the running of the watch under test can be detected by examining the calibrated strip for variations in the distances between the two sounds of the tick and between each tick.

Aerial Sowing of Wheat

EAST WEST AIR LINES, of Australia, have been experimenting with the sowing of wheat from the air. Flying at 40 feet, four acres to the minute were handled, and distribution of the seed was said to be satisfactory. The experiment was made at the urgent request of Queensland growers who were unable to sow owing to heavy rain, and is a new departure for Australian farmers.

Backing a Loser

AT Inglewood, California, recently, Mr. J. W. Keeley was fined for low flying over Hollywood Park race-track when a horse race meeting was in progress. A witness who was watching from a grandstand at the time of the occurrence declared that Keeley's aircraft was below eye level as it flew around the track behind the horses during a race. Mr. Keeley was further accused by another witness of touching some trees with his aircraft. He pleaded guilty and was fined $400.

News in Brief

MRS. MORROW-TAIT, who was attempting a flight round the world, took off from Croydon on August 18th in a Proctor fitted with long-range tanks. She reached Marseilles the same night, damaged the machine, and plans to make another start.

* * *

Work has been started on the dismantling of the large airship hangar at Pulham, Norfolk. This building, which covers four acres, is 800ft long, 180ft across and 130ft high, was erected during the 1914-18 war and is expected to yield a large quantity of steel.

* * *

The Council of the Royal Society of Arts is offering a prize of £50 for an essay on the Application of Radar to Navigation. This award is to be made under the Thomas Gray Memorial Trust. Details are available from the Society at John Adam Street, Strand, W.C.2.

* * *

Sir Stafford Cripps recently visited the Speke factory of Dunlops and remarked that the plant was probably the best laid out rubber manufacturing plant in the world. The plant already employs 6,500 people and is expected to increase this figure in the course of its development.

* * *

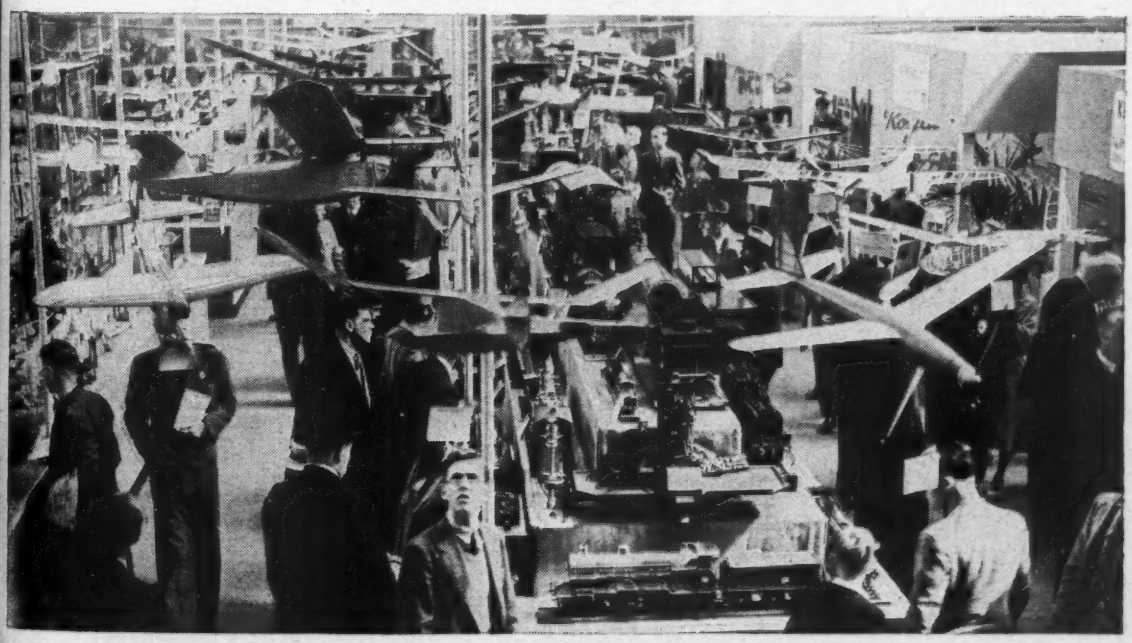
At the invitation of the government of India, Sir Ben Lockspeiser, Chief Scientist, Ministry of Supply, left the U.K. by air on August 16th to act as a member of the Quinquennial Reviewing Committee of the Indian Institute of Science, Bangalore. The Committee is under the chairmanship of Sir Alfred Egerton, Secretary of the Royal Society.

* * *

Mr. Whitney Straight and Lady Daphne Straight recently flew from Croydon in a Gemini belonging to B.O.A.C. to inspect stations used by the Corporation in the Mediterranean area. He piloted the Gemini himself. Mr. Straight expects to visit Montreal shortly to check progress on the Canadair Four order.

* * *

A Portuguese Air Mission, headed by Brigadier Alfredo Delesque dos Santos Cintra, arrived in the U.K. on August 19th at the invitation of His Majesty's Government. The Mission is to review the progress made in British aviation and arrangements are being made for a visit to the S.B.A.C. flying display and exhibition at Farnborough.



MODEL EXHIBITION : This general view of the Model Engineers' Exhibition, referred to elsewhere in this issue, shows many of the model aircraft, some gliders, and some powered by miniature internal combustion engines or rubber motors.

Display and Competitions at Brough

Cirrus Trophy Contest : Strong Service Support

ALTHOUGH Brough, East Yorkshire, has been connected with flying since the very early days through its association with Blackburn Aircraft, Ltd., No. 4 E.F.T.S. and its Flying Club, it is a long time since it was the scene of an air display and garden party. On Saturday, August 21st, however, the local branch of the Royal Aeronautical Society and Brough Flying Club were the hosts and organizers of a very enjoyable air meeting. In addition to several excellent demonstrations by a variety of R.A.F. and Navy aircraft, the big event of the afternoon, after the official opening by A. Cdre. B. V. Reynolds, C.B.E., A.O.C. 64 Group H.Q., Northern Reserve, was the competition for the Cirrus Trophy. This was open to all pilots except members of the local club, and was flown in standard Cirrus-Minor Austers.

Twenty minutes before take-off the crew of two in each Auster were given references for four turning points on a 152½-mile course. Previously the aircraft had all been filled up to capacity and lined-up for starting. The aim of the contestants was, by careful handling of aircraft and engine, good airmanship and accurate navigation, to complete the course with the minimum consumption of fuel. A number of marks were also given for speed, and a small bonus (five marks) for starting up, landing and pilot's experience (or, more correctly, lack of it). Thus it will be seen that the competition was a fine training exercise.

Trophy Winners

Four handsome prizes were offered, and eleven crews took part, the man with the greater number of hours being named captain, whether flying or navigating. Winners of the Cup and £50, against strong competition from Mr. Snarey, Auster chief test pilot, Mr. Franklin, of Armstrong Whitworth, Capt. Byas, etc., were F/L. J. R. Saunders (Capt.) and Mr. V. Gordon White (pilot), flying number 11, a Speeton Club Auster. They secured 143.9 marks out of a possible 150, used 6.8 gallons of petrol and averaged 96 m.p.h. This represents the remarkably low consumption from the Cirrus Minor of 4.1 g.p.h. Second was Mr. H. C. Rogers, C.F.I. of the Nottingham Club, who received 140.7 marks and used 7.125 gallons. His prize was a cheque for £25. Third, and winner of £15, came Mr. L. Larsen, C.F.I. of the East Riding Club (Lockwoods Flying Services) at Speeton, who obtained 139.7 marks and used 7.125 gallons. F/L. Wright, of the Tees-side Club at West Hartlepool, was fourth (£10 cheque) with 138.5 marks. He was the third to record a consumption of 7.125 gall.

The winners flew at an average engine speed of 2,200 r.p.m., giving 97 m.p.h. I.A.S. F/L. Saunders said afterwards that they were never more than a quarter of a mile off track, and flew at about 1,000ft down wind and 100ft into wind. The turning points, to be circled at 500ft were Sutton Bank (near the White Horse), Bellasize airfield, Sledmere Memorial, and Speeton airfield.

While the competition was taking place, Lt. Cdr. Coxon, and his squadron from Anthorn, gave a fine exhibition of flying—Navy style—in their Firebrands. "Carrier" take-off and formation flying were followed by simulated deck landings on the one runway which, incidentally, was at least 60 deg. out of a strong wind, but which did not apparently bother the squadron.

Almost all the R.A.F. aircraft were from the Central Gunnery School at Leconfield. Two Mosquitoes flew past on one and two engines each, and one pleased the connoisseurs with a smooth, gently climbing roll on one fan. The pilots were F/L. Lelong, D.F.C., and F/O. Cutter.

East Yorks spectators saw—many for the first time—a Vampire put through its paces by S/L. Frank Bradley, D.S.O., and a Meteor 3 by W/C. A. H. Donaldson, D.S.O., D.F.C., A.F.C.

All present were suitably impressed, and the pilots of these aircraft, and particularly F/L. Sargher, D.F.C., and F/O. Easy in two Spitfire 16s, which later did synchronized low-level aerobatics, are to be congratulated on pressing on regardless of the rapidly deteriorating weather.

After a start in sunshine, rain and poor visibility finally forced the abandonment of the last few events, which were to have included paratroop descents from a 38 Group Dakota by the local regiment under the command of Major Widdoson, and a mass fly-past of types present.

An outstanding event was the short demonstration of the S.28/43 Firecrest, given by Mr. P. G. Lawrence, chief test pilot of the Blackburn company. Following an exceptionally steep initial climb, the effect of power-operated ailerons was shown by the remarkably high rate of roll. On one occasion he executed five climbing rolls in quick succession.

Two demonstrations much appreciated were Lt. Sproule's brief flight in a Navy Olympia sailplane, and the Slingsby Motor Tutor making one of its first public appearances. This intriguing ultra-light with 35 h.p. engine and 60 m.p.h. cruising speed showed itself to have good features picked from both glider and light aircraft.

The full and varied programme also included popular events such as formation aerobatics and pupil and instructor comics in Tigers, aerobatics by a Percival Prentice, and a final high-spot, the Brough Flying Club handicap race. In this event, three Tigers, an Auster, a B.2 and a Swallow competed over a closed circuit round the airfield. P. G. Lawrence was the winner of the Trophy in a Tiger Moth, and Mr. Egglestone came second in the Swallow.

Prizes were presented by the Lady Mayoress of Hull; Capt. Norman Blackburn welcomed the guests; and Mr. Petty, chief designer of Blackburn Aircraft, spoke as chairman of the Brough branch of the Royal Aeronautical Society. The capable and hardworking announcer for the flying display was Mr. M. G. K. Byne.

Model Engineering Exhibition

MODEL aircraft, ranging from gliders to jet-propelled scale models of the D.H.108 and Vampire, are prominent at the Model Engineering Exhibition being held at the New Horticultural hall, Westminster, from August 18th to 28th. In a circular enclosure, bounded by a water track for hydroplanes and model boats, and by a circular track for model racing cars, control-line flying demonstrations are being given several times a day. The aircraft are powered by miniature internal combustion engines and are handled with considerable skill, especially as the "runway" is less than 2ft wide. Some of the flights have ended in spectacular crashes as in one case, where the wrong length of the control lines caused a model to dive straight in from 15ft just after taking off; the only damage appeared to be a shattered propeller. Another model had its wing span reduced by over an inch when it connected with the wire safety fence, but continued to fly with undiminished performance. The D.H.108 and Vampire models, though not on control lines—they were only anchored to a central stake—took off, flew and landed in a most realistic manner accompanied by powerful hisses from the "Jetex" jet-propulsion units. An aircraft motor is exhibited which derives its power from a small cylinder of compressed carbon-dioxide such as is used for making soda-water.

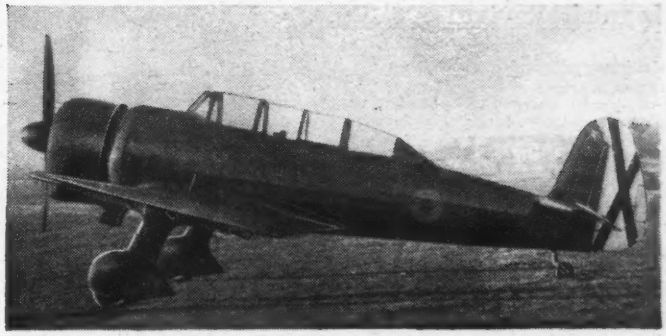
Among the jet-propulsion exhibits is a unit known as the "Juggernaut," which produces 3½ lb static thrust employing the same principle as the German V-1 flying bombs. The smallest diesel engine at the exhibition, and probably in the world, has a capacity of only 0.04 c.c., and weighs only 9½ grammes; it runs at 7,000 r.p.m. Another small diesel engine of 0.2 c.c. capacity is claimed to be capable of driving an aircraft of 2ft wing span. Scaling this up to full size in proportion, it is equivalent to flying a Tudor with an engine of about 12 c.c.! A scale model of a Lysander is exhibited by the Handley Page Model Engineering Society and is remarkable for its high quality of detail and finish.

One of the model racing cars ran at such a speed as to be airborne for most of its journey, the front wheels only touching the track intermittently. Besides the active demonstrations on the circular track the exhibition is packed with models of every description ranging from J. O. C. Samuel's 7¼in gauge (anthracite fired) Pacific type locomotive capable of hauling 25 adults, down to a tiny model of a sailing ship about the size of a halfpenny in a small glass jar. A wide variety of model engineers' tools, machine tools, equipment and everything a model maker could desire for his workshop is also displayed.

Spanish Revival

Aircraft Industry Gradually Overcoming Effects of Civil War

By WILLIAM GREEN

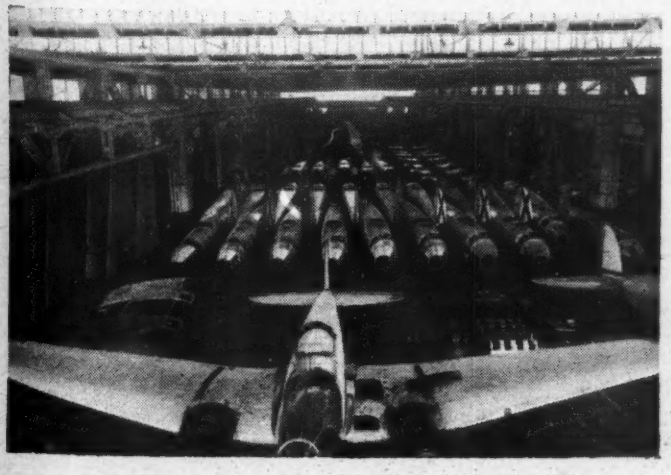


Hispano-Suiza H.S.42B, two-seat advanced trainer.

OWING to political upheavals and civil war, the Spanish aircraft industry has never succeeded in attaining a standard comparable with the industries of other important European countries. From time to time attempts have been made to foster the industry's growth, but the revolt of the Nationalist forces under Generalissimo Franco in 1936 precluded any further effort in this direction until some ten years ago.

Considerable reorganization of the Spanish aircraft industry has been effected during the past ten years, and at present three major aircraft manufacturers: Aeronáutica Industrial S.A., La Hispano Aviación S.A., and Construcciones Aeronáuticas S.A., are producing aircraft of both national and foreign design. Two companies, Elizalde S.A. and Hispano-Suiza S.A., are building aircraft engines. These concerns are supplemented by a sizeable accessories industry, the most important company of which is the Industrias Subsidiarias de Aviación S.A.

An Me 109J, Spanish variant of the 10ˆG.



Heinkel 111P bomber assembly by Construcciones Aeronáuticas S.A.

La Hispano Aviación, which is a branch of the partially state-controlled Hispano-Suiza, Fábrica de Automoviles S.A., is devoted to the construction of military aircraft of both national and foreign design at their Seville factory.

The Hispano factory, which was completely destroyed during the Civil War, was rebuilt and completed in 1942, and its first product was a version of the Hispano E.34 two-seat primary training biplane, originally designed in 1935 to compete in trials intended to evolve training aircraft suitable for production in Spain. The 1935 model was powered by a 105 h.p. Walter Junior engine and was awarded second place in the contest. A production order was placed, but before production commenced the factory was destroyed. The post-Civil War version differed in being powered by a 130 h.p. Gipsy Major. However, as Hispano's production space was needed for the manufacture of military aircraft, and as the C.A.S.A. factories had started the production of the Bücker Bü 131 and 133 training biplanes, the E.34 was not built in quantity.

First nationally-designed aircraft to be produced in numbers by Hispano, after the reconstruction of the Seville factory, was the H.S.42 two-seat advanced trainer, approximating to the North American Harvard. The prototype was powered by a 430 h.p. Piaggio P.VIIC.16 seven-cylinder radial air-cooled engine, and it was eventually intended to replace this with a Hispano-Suiza H.S.93 engine. However, the version produced in quantity for the Ejercito del Aire's training squadrons is powered by a 475 h.p. Armstrong Siddeley Cheetah seven-cylinder radial air-cooled engine, and is known as the H.S.42B.

The H.S.42B is a low-wing cantilever monoplane of mixed construction. The undercarriage (of tail-wheel type) is fixed and enclosed in streamlined fairings. Accommodation is provided for a crew of two in tandem cockpits enclosed by a continuous canopy with sliding sections over the two seats. A gunnery-training version has fixed forward-firing machine guns mounted in the engine cowling and a flexible gun in the rear cockpit.

Spanish Revival . . . . .

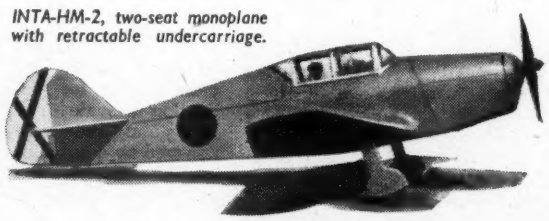
Maximum and cruising speeds are approximately 197 m.p.h. and 178 m.p.h. respectively.

In 1942 it became obvious that the Ejercito del Aire needed a modern single-seat fighter to replace the miscellany of obsolete foreign types then in service. As a considerable amount of experience had been gained by Spanish pilots with the early Messerschmitt Bf 109, it was decided to adopt a later development of this aircraft for production in Spain, and Hispano Aviación was awarded a contract to manufacture a large number of these aircraft to re-equip Spanish fighter squadrons.

At that time the Messerschmitt Me 109G was entering service with the Luftwaffe and a modified version of this aircraft, known as the H.S.109J, was placed in production at Seville. The H.S.109J, which now forms the equipment of the majority of Spanish fighter squadrons, differs from the Me 109G in a number of respects. The main modification is to be seen in the installation of the engine. This is a Spanish-built version of the Daimler-Benz DB 605, known as the Hispano-Suiza 12-Z-89, developing 1,300 h.p. and built by the Barcelona aircraft engine factory of La Hispano-Suiza, Fábrica de Automoviles.

Whereas the DB 605 engine of the Me 109G was installed in an inverted position, the H.S. 12-Z-89 is installed upright, consequently altering the contours of the engine cowling appreciably. Other modifications include the enlarging of the coolant radiator under the engine cowling and the installation of a large tropical filter. Performance figures and weights for the H.S.109J are as follows: Maximum speed, 394.6 m.p.h.;

INTA-HM-2, two-seat monoplane with retractable undercarriage.



landing speed, 68.4 m.p.h.; ceiling, 42,651ft; range, 435 miles. Weight empty, 4,234lb; weight loaded, 6,724lb.

Recently a new Spanish society, the Institute Nacional de Industria, was formed to give impetus to the Hispano-Suiza concern, and it is thought probable that this organization plans to negotiate with this country for aero engine manufacturing licences.

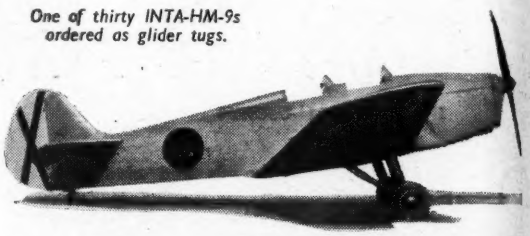
Hispano-Suiza S.A. is engaged in manufacturing aircraft engines for the Spanish government. By the summer of 1939 the Barcelona plant had been reconditioned and was in full-scale production. Little information is as yet available concerning the engines built by this company, although it is known that the company designed a 450 h.p. radial engine, the H.S.93, intended for installation in the H.S.42 advanced training monoplane, and is probably at present engaged in fulfilling contracts for the H.S. 12-Z-89 engine for installation in the Hispano-built 109J fighter and the C.A.S.A.-built Heinkel He 111P bomber.

C.A.S.A

The Construcciones Aeronáuticas S.A. is the most important manufacturer of aircraft in Spain, with factories at Getafe, Seville and Cadiz, wherein are built various types of aircraft of foreign design for the Ejercito del Aire. Before the Civil War, this company, in the two factories it then possessed at Getafe and Cadiz, built 400 Breguet XIX reconnaissance biplanes and 40 Dornier Wal twin-engined reconnaissance flying boats. Since 1938 the Getafe and Cadiz factories have been considerably expanded and a new plant built at Seville.

In 1939 the Cadiz factory commenced the series construction of the Bücker Bü 131 Jungmann two-seat primary training biplane and the Bü 133 Jungmeister single-seat advanced training biplane for Spanish training squadrons. In 1942 the company was successful in obtaining a contract to build large quantities of the Heinkel He 111 twin-engined bomber, the

One of thirty INTA-HM-9s ordered as glider tugs.



wings of which are produced at the Getafe plant and the centre sections at the Seville plant. The C.A.S.A.-built He 111 does not differ from the German version in any major respect and approximates to the Heinkel He 111P of the late Luftwaffe, being powered by two Hispano-Suiza 12-Z-89 twelve-cylinder upright Vee liquid-cooled engines.

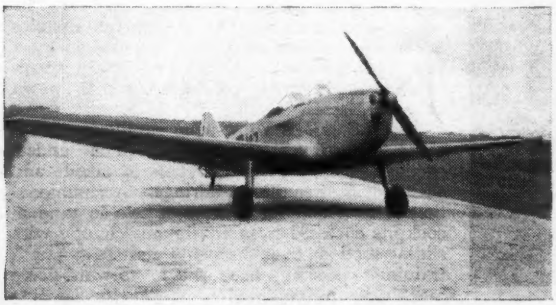
In addition to the aforementioned types, C.A.S.A. have built numbers of Junkers Ju 52/3M three-engined transport monoplanes for the Spanish government. The C.A.S.A.-built Ju 52/3M is powered by three 750 h.p. B.M.W.132 radials built under licence by Elizalde S.A.

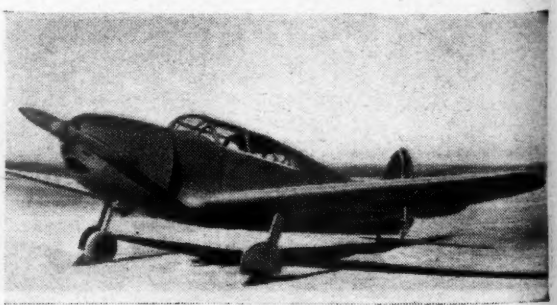
A.I.S.A.

The third aircraft manufacturing company in Spain is the Aeronáutica Industrial S.A. who build nationally-designed aircraft at their Carabanchel Alto factory near Madrid. The A.I.S.A. concern was originally organized by Dr. Jorge Loring in 1923. The factory built various types, such as the Loring C.1, R.1, R.111 and González Pazo GP-1 and 2, until it was totally destroyed during the Civil War.

After the war the present factory was built and has since produced a number of original types designed by Lt. Col. Huarte Mendicoa, of the Instituto Nacional de Tecnica Aeronautica. The first of these, the INTA-HM-1, which appeared in 1943, is a two-seat primary trainer. The HM-1 is a low-wing cantilever monoplane of mixed construction with a fixed tail-down undercarriage and powered by the 150 h.p. Hirth HM 506 four-cylinder inverted air-cooled engine. Successful flight trials with this prototype resulted in an order from the Ministorio del Aire for seventy HM-1s powered by the nationally-designed Elizalde Tigre G-IV-B four-cylinder in-line inverted air-cooled engine of 150 h.p. Performance figures for the prototype are as follows: Maximum speed, 142.9 m.p.h.; cruising speed, 121.1 m.p.h.; range, 435 miles. Weights are: empty, 1,366lb; loaded, 1,873lb. A twin-float seaplane version of the HM-1, known as the INTA-HM-3 and intended for use as a seaplane trainer, was built last year and has since undergone considerable flight testing.

The second of Lt. Col. Mendicoa's designs to be built by A.I.S.A. was a pleasant two-seat cabin monoplane, the INTA-HM-2. It is a cantilever low-wing monoplane of mixed construction, claiming the distinction of being the first





Two more INTA designs, the HM-1 Primary Trainer and the HM-7 Argus-engined four-seat tourer.

nationally-designed aircraft to have a fully-retractable undercarriage. The prototype is powered by a Hirth HM 506, but production models will have the Tigre G-IV-B. Maximum and cruising speeds are 143 and 121 m.p.h. respectively; range is 372.8 miles; weight empty, 1,476lb; weight when loaded, 1,874lb.

A scaled-down single-seat version of the HM-1 has been produced for aerobatic training and is designated INTA-HM-5. Dimensions and weights are reduced appreciably, and performance is increased, maximum speed being 149 m.p.h., cruising speed 127.3 m.p.h., and range 318 miles. The HM-5 is a low-wing cantilever monoplane of mixed construction and powered by a 150 h.p. Hirth HM 506.

In 1946 the company built the prototype of the INTA-HM-7, a single-engined four-seat touring monoplane bearing a marked similarity to the Messerschmitt Bf108. The HM-7 is a low-wing cantilever monoplane with a retractable undercarriage and powered by a 240 h.p. Argus As 10C inverted in-line air-cooled engine. Weight and performance details are: Maximum speed, 118 m.p.h.; cruising speed 112 m.p.h.; landing speed (flaps up) 63 m.p.h., (flaps down) 57 m.p.h.; empty weight, 1,540lb; loaded weight, 2,640lb. A.I.S.A. is at present engaged in completing a production order for thirty INTA-HM-9 glider tugs. Except for the undercarriage—which has tripod legs—and a slight increase in overall dimensions, the HM-9 is very similar in appearance to the HM-1 trainer.

An interesting prototype built by A.I.S.A. was the Iberavia IP-2 training glider. The IP-2, which is of exceptionally clean design and embodies the unique feature (for a glider) of a fully retractable tricycle undercarriage, was built for the Iberavia S.A., which company is engaged on an extensive glider development programme. The IP-2 is a low-wing cantilever monoplane of composite construction; single-spar, plywood-skinned trapezoidal wing with rounded tips; an unusually slender fuselage of welded steel-tube framework with fabric covering, plywood covered nose and an enclosed cabin seating a crew of two in tandem seats with dual controls. The IP-2 will be used to train pilots to participate in the later phases of the development programme intended to prove the glider as an economical unit of air transportation. It is considered possible that powered versions of the IP-2 will be built. Future production at the A.I.S.A. plant is to include both the Miles Messenger and Gemini light aircraft.

Elizalde S.A.

The Elizalde S.A. was founded in 1910 and manufactured automobiles until 1925, in which year the company began the production of engines with licences to build Lorraine types. These were followed by the production of the Hispano-Suiza A-4 and A-5 engines for the Breguet XIX and Dornier Wal aircraft built by C.A.S.A. The company also produced two types of air-cooled radial engines known as the Dragon IX and the Super-Dragon, of 470 and 750 horse power respectively. A licence to build the Pratt & Whitney Hornet engine was acquired and the company was preparing for production when the Civil War broke out.

Having reorganized and re-equipped its plant after the Civil War, the Elizalde company started producing 750 h.p. B.M.W. 132 radial engines—similar to the Pratt & Whitney Hornet—for installation in the C.A.S.A.-built Ju 52/3Ms. More recently, the company has developed a series of low-powered engines known as the Tigre series. The first engine of this series is the four-cylinder Tigre IV, of which two models are produced: the IV-A and IV-B with outputs of 125 and 150 h.p. respectively. Further developments of this series are the six-cylinder Tigre VI, the eight-cylinder Tigre VIII, and the twelve-cylinder Tigre XII, all of which are supercharged. In 1944 the company produced a new 450 h.p. seven-cylinder air-cooled radial engine known as the Sirio S-VII-A.

The Spanish Army of the Air

The Ejercito del Aire was founded in October, 1939, as an independent arm equal in status to the Army and Navy, and consisting of a High Command, flying and ground personnel, airborne troops, anti-aircraft units, transport, technical and communication services.

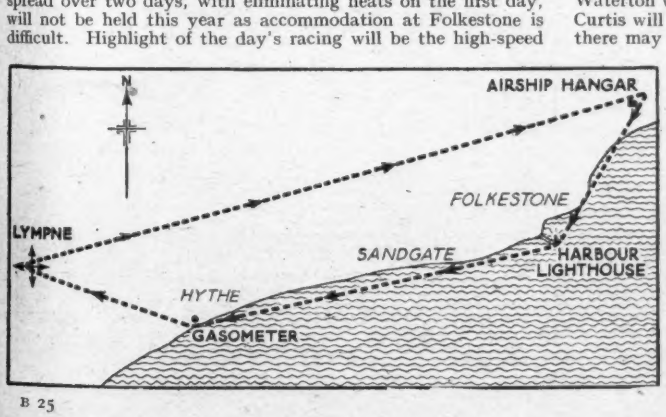
The Spanish Peninsula is divided into five Air Regions and the Spanish Colonies into three Air Zones, each Region or Zone having its own Air Staff, operational and training units and the necessary ancillary establishments. Aircrew training is provided at the various elementary and transitional schools, and in advanced and operational schools for fighter, bomber and reconnaissance crews. Ground staff are trained in the apprentice schools attached to each Air Region, and specialized schools are provided for wireless-operators, photographers, engine and airframe mechanics, fitters, armourers and electricians. Control is administered by the Air Ministry, which was founded in August, 1939.

As will be recalled, Spain became the operational testing ground for the military aircraft types of many European powers, and, during the Civil War, aircraft construction in Spanish factories came to a standstill, although maintenance and repair factories were established by Generalissimo Franco's forces during the latter stages of the war. Thus, by the time the war ended in 1938, the majority of aircraft flying in Spain were of foreign origin, and a proportion of Spain's operational squadrons are still equipped with such aircraft as existed in both zones at the end of the war. These include the Spanish-built British Vickers Vildebeest and German Dornier Wal, the Italian Fiat C.R.32, 42 and B.R. 20, the Savoia Marchetti S.M.79 and 81, the German Messerschmitt Bf 109B and C, and the Russian I-15, I-16 and SB-2.

Thus, at present, the Ejercito del Aire, as an air arm, is of considerably lower standard than those of most other European nations. However, this miscellany is gradually being replaced from the production of Spanish factories, i.e.: the C.A.S.A.-built He 111 and the Hispano-built H.S. 109J, etc., and it is highly probable that nationally-designed military types will be forthcoming.

THE LYMPNE RACES

HIGH-SPEED races and other events promise to make this year's one-day flying meeting at Lympne even more outstanding than either of the last two. Flying starts at 1400 hours on Saturday, August 28th, but the dinner-dance organized so successfully annually by the Cinque Ports Flying Club will be held the night before at the Metropole Hotel, Folkestone. The Folkestone Aero Trophy handicap race, which is normally spread over two days, with eliminating heats on the first day, will not be held this year as accommodation at Folkestone is difficult. Highlight of the day's racing will be the high-speed handicap race over the Folkestone trophy race course. A new challenge cup, presented by colleagues of the late Geoffrey de Havilland and bearing his name, will be awarded for fastest time. There are six entries. F. A. Matthews in a Fairey Firefly, T. S. Wade in a Hawker Fury, and John Cunningham, probably in a de Havilland Vampire. Vickers cannot spare an Attacker, and so M. J. Lithgow will fly a Spitfire Trainer; S/L. Waterton will fly a Meteor, possibly a Trainer, and Miss Lettice Curtis will fly Mr. L. Satterthwaite's Spitfire II. It is possible there may be a French entry, but no details are available.



An Inter-Auxiliary Squadron map-reading competition will be held over a 100-mile course from Lympne to Crowhurst, Friston, Paddock Wood and back to Lympne. Although competitors will be aware of the approximate course, the precise turning points will not be divulged until 10 minutes before the race starts. The race will include five Spitfires and two Mosquitoes representing one aircraft from each Auxiliary Squadron. During the afternoon there will also be type races for Magister, Tiger and Tipsy aircraft over three laps of a five-mile course around the airfield, and high-speed aerobatics by one of the R.A.F. Vampire squadrons from Odiham. Amongst other aerobatics and demonstrations will be Mr. L. C. Marmol, who put up such an impressive show last year with his Krajanek glider. Mr. Rowarth and Mr. Dancy are responsible for handicapping.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

PASSENGER PARACHUTES
Hovering the Real Solution

I HAVE read the letter by your correspondent D. G. H. in *Flight* of July 15th, and while agreeing that the provision of individual parachutes may be necessary, I still consider that means of saving the aircraft itself, and its passengers and crew the necessity of leaving it, either individually or otherwise, should be the main objective of future development.

Since learning to fly in the 1914-1918 war I have seen aircraft grow out of all recognition compared with the equipment we then used, but the necessity to maintain a comparatively high speed under any conditions, and the alternative uncontrolled dive, are still with us.

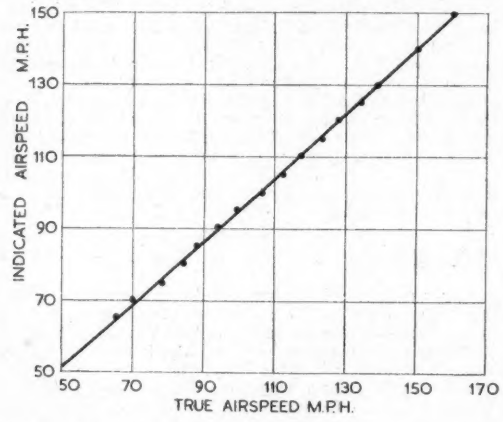
The modern aircraft is a good looking and substantial piece of engineering, and I am sure that recent developments in power units have brought the day nearer when aircraft will hover under perfect control, awaiting their turn to make a slow-speed landing; and this with very little departure from their present design.

It is going to cost money, but I am convinced that in this direction lies the solution of many of today's disasters.

Stroud, Glos. ALLEN E. JEFFRIES, M.S.W.I.E.

PROMOTOR PERFORMANCE
Position Errors to be Remedied

I HAVE received *Flight* of August 5th containing your opinion and experience of the Promotor. Our chief designer, Mr. Beeling, in reading through the article, told me that the speeds indicated by us in our pamphlets have been officially measured, and from your article it appears that there should be some doubt about the speed indicated by us. I enclose a copy of the official graph of the calibration of this



air speed indicator, from which you will see that the errors of the indicator may be neglected at low speed, but that this difference in indication increases to about 10 m.p.h. at high speed. It is our intention to place the pitot static tube in a better position in order to avoid this error.

H. VAN BEEM,
Amsterdam. Publicity Manager, "Fokker."

THE CANADAIR PURCHASE
Why Not Tudor VII.s ?

WITH reference to the Tudor aircraft "debâcle," which has been so aptly described as "the muddle without parallel in British aviation," and which has led to the purchase of Canadian-built D.C.4 M aircraft, it is noted with regret that apparently no mention has been made, either in the House or in the national Press, of the existence of the Tudor Mark VII aircraft.

We are led to believe by the report of the Courtney Committee that the main reasons for the rejection of the Tudor II are two-fold: (1) lack of take-off power, and (2) insufficient specific air range. We are further informed that the Tudor VII overcomes both these objections.

Why, therefore, has not this apparently simple solution to the question "Why not fly British?" been adopted?

Apart from the question of dollars, prestige, etc., the Tudor airframes and Hercules engines are available, and the combination could be flying on our civil air routes at a considerably earlier date than the Canadair aircraft, which are not, as yet, constructed for B.O.A.C.

Further, it is pertinent to point out that the specific air range of the Canadair aircraft is inferior to that of the Tudor VII. Also the noise level of the Tudor VII, a major factor affecting passengers' comfort, is reputed to be the lowest of any four-engined commercial aircraft in the world.

In view of the above statements, which have been substantiated, it is wondered why the present pathetic state of affairs has been allowed to arise, and it would appear that some section of the authorities has a peculiar axe to grind in a peculiarly ulterior manner.

We feel that these thoughts are very prominent in the minds of the technicians of the aircraft industry and would welcome some explanation. W. H. D.

Blackpool. J. Y. T.

ANOTHER PLEA FOR TIGER REPLACEMENT
Why Not Prentices for the V.R.?

SOME time ago you reported Mr. Whitney Straight as saying: "It is one thing to fly an uneconomical aircraft so long as the aircraft is filled with passengers, but if you fly an uneconomical aircraft empty, then you are in serious trouble. I regret to say that is what was beginning to happen." In other words, passengers were no longer prepared to put up with the old bomber conversions when modern airliners were available.

It seems to me there is a direct parallel between this situation and the V.R. I do not suggest that the Tiger is uneconomical, but it is fairly common knowledge that most V.R. pilots are browned off with Tigers, and that quite a lot of other younger ex-R.A.F. types would sign on for the V.R. if there was something more useful and interesting to fly than the old Tiger. A sure way to get a whole lot more pilots to join the V.R. and to get a whole lot more enthusiasm out of those already in would be to give the schools a new aircraft at once. The newspapers said some months ago that Chipmunks were to be given to the V.R., but since then no more has been heard and nothing seems to have happened. It seems to me that experienced pilots could make better use of Prentices for practice and polishing-up than the *ab initios* for whom they were built, and, what is more, plenty of Prentices appear to be coming through. Why not a few Prentices for the R.A.F.V.R. if the more advanced machines are exclusively for Navy V.R.s and Auxiliaries? A. J. WALKER.

London, S.W.3.

FORTHCOMING EVENTS

Aug. 18th to 28th.—Model Engineer exhibition, New Royal Horticultural Hall, Westminster.
Aug. 26th to Sept. 11th.—Machine Tool and Engineering exhibition, Olympia, London.
Aug. 27th to Sept. 5th.—Aero Club de France. "Tour de France."
Aug. 28th.—R.Ae.S. (Graduate and Student): Visit to Vickers-Armstrongs.
Aug. 28th and 29th.—Cinque Ports Flying Club: International flying meeting, Lympne airport.
Aug. 28th and 29th.—Aero Club de Touraine: Rally, Internationale des Grands Vins de Touraine.
Aug. 29th and 30th.—Ghent Aviation Club: International Air Rally, Ostend.
Sept. 4th.—Northants Aero Club: Air display at Sywell. (Cancelled).
Sept. 4th.—Butlin's Week-end Air Rally, Speeton, Filey, Yorks.
Sept. 4th.—Bristol and Wessex Aeroplane Club: Air display, Whitchurch airfield, Bristol.
Sept. 5th.—Light aircraft rally and model flying meeting, Flers, France.
Sept. 7th to 12th.—S.B.A.C. Exhibition and Display, Farnborough airfield, Hants.
Sept. 12th.—Royal Air Forces Association: Festival of the Battle of Britain at the Royal Albert Hall.
Sept. 18th to Oct. 3rd.—Copenhagen Show, organized by the F.B.I.
Sept. 18th and 19th.—Aero Club of Milan: Air rally, Forlanini airfield, Milan.
Sept. 25th and 26th.—Butlin's Week-end Air Rally at Ingoldmells, Skegness.
Sept. 26th and 27th.—International air rally, Chateauneuf Airport, Sion, Switzerland.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

A Good Month

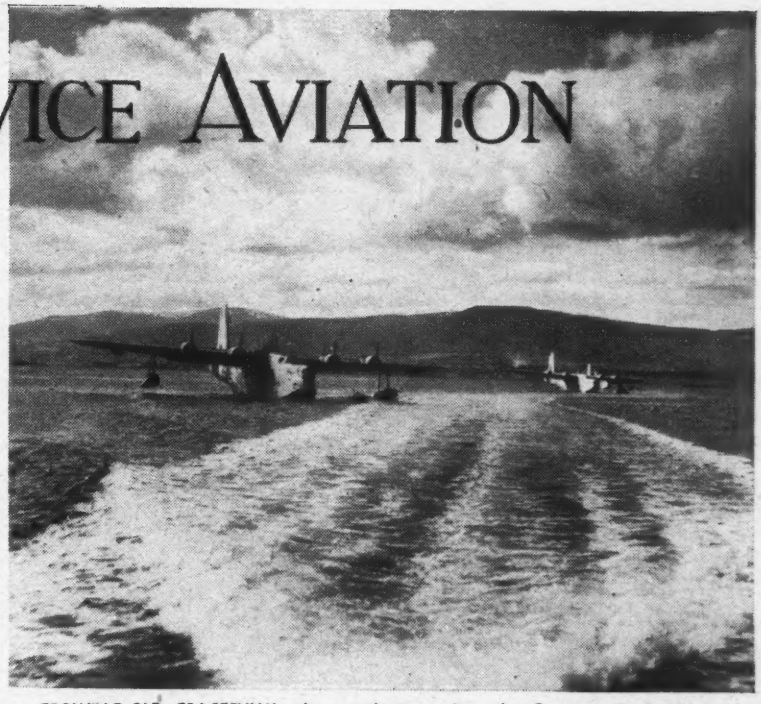
LATEST available figures show that June was a good month for recruiting in the R.A.F.V.R., the R.Aux.A.F. and the Royal Observer Corps, the grand total of volunteers reaching 963. During the month, 108 airmen gunners and other tradesmen were enrolled in the new Royal Auxiliary Air Force Light Anti-Aircraft Regiment Squadrons, while Flying Squadrons increased their ground crews by 41 and there were 55 volunteers for Air Defence Units, 31 of whom were women joining the W.A.A.F./R List.

The Royal Air Force Volunteer Reserve figures show an increase for the month of 176 officers and aircrew, 150 of the latter being enrolled at Reserve Flying Schools and 26 for *ab initio* and refresher training at University Air Squadrons. Women pilots (W.A.A.F./V.R. List) now number 31.

Norwegian Meteorologist Honoured

THE King has approved the appointment of Dr. Sverre Petterssen, a Norwegian meteorologist, as an Honorary Commander of the Order of the British Empire in recognition of his outstanding services to the Meteorological Office during the war, which contributed greatly to the success of the Allied Forces.

Dr. Petterssen, who has been Chief of the Norwegian Meteorological Service since December, 1945, was weather forecaster for Western Norway from 1931 to 1939 and was afterwards Professor and chief of the department of meteorology, in Massachusetts Institute of Technology, Cambridge, U.S.A. He volunteered for war service in Great Britain in November 1941, working first as an adviser to the Admiralty before becoming an adviser to the Meteorological Office, Air Ministry, in the following year. From October, 1942, he commanded the aerological section of the Meteorological Office with the task of developing new methods of forecasting weather and wind in the higher stratosphere, particularly for the bombing of Germany. In January and February, 1944, he was adviser to the British and American forces in the Mediterranean theatre and for the landing south of Rome on January 21st. Later he assisted in the preparations and weather forecasting of the Normandy landings. For his services in this connection he received personal letters of thanks from General Eisenhower and the Air Council.



GROWING OLD GRACEFULLY: In a majestic setting—the Cromarty Forth—three of Coastal Command's trusty Sunderlands ride at anchor. No type of flying boat has made more history than this stately Short.

V.I.P. Squadron

NUMBER 24 (Commonwealth) Squadron of Transport Command, R.A.F. has now added another name to the long list of "V.I.P.s" carried in its aircraft—that of the Shah of Iran. He was flown to this country, and taken to Paris, in one of the squadron's four-engined Avro Yorks. This squadron, based at Bassingbourn, Herts., is the V.I.P. squadron of the R.A.F., and is equipped with Yorks and Dakotas. Its passengers have included members of the Royal Family, the Cabinet and the Chiefs of Staff, and many leading personages of other countries. The York recently used by the Shah of Iran was No. MW 140, formerly known as the *Endeavour*, and was used by H.R.H. the Duke of Gloucester during his tour as Governor-General of Australia. It is now one of No. 24 Squadron's regular fleet, along with other famous Yorks, such as MW 100 and MW 101, and is available for V.I.P. work in all parts of the world.

Battle of Britain Service

A SERVICE of Thanksgiving for the victory achieved in the Battle of Britain in 1940 will be held in Westminster Abbey on Sunday, September 19th, at 3 p.m. Applications for tickets from widows and parents of aircrew who lost their lives in the Battle, and from retired Royal Air Force officers and Battle of Britain pilots who wish to attend the Service should be sent to the Under-Secretary of State (S.4) Air Ministry, Whitehall, S.W.1, in writing not later than September 4. In view of the limited number of seats in the Abbey not more than two tickets can be issued to any applicant. Application for tickets should not be sent to the Abbey.

High-speed Map Reading

A HIGH-SPEED map reading competition in which Royal Auxiliary Air Force squadrons will compete for a challenge trophy will be a feature of the flying events at the International Air Meeting to be held at Lympne on Saturday next, August 28th. The Trophy will be competed for by one representative from each of the 6 Reserve Groups and from R.A.F., Northern Ireland, and the race will be flown to and from Lympne over the 100-mile route which will not be disclosed to pilots until ten minutes before their time of take-off. Pilots will be handed maps marked with tracks and courses ten minutes before take-off and each type of aircraft will be handicapped by an official handicapper at Lympne, so that the winner will have to depend as much upon his skill in "pin-pointing" his position in the air by reading his map as upon his skill in handling the aircraft. Each aircraft will be tracked by the Royal Observer Corps or the Royal Corps of Signals who will signal the turns.

Aircraft will be handicapped in accordance with maker's figures for performance of each type and mark of aircraft. These will include Spitfire Marks, 14, 16, 21 and 22, and Mosquito Mark 30.

Concession for Cadets

CADETS of the Air Training Corps who obtain the Higher School Certificate may be granted the A.T.C. Proficiency Certificate and Badge, and the Advanced Training Badge if they satisfactorily complete the compulsory sections of the Proficiency and Advanced Training curriculum and have taken mathematics or science in the Higher School Certificate examination.

Service Aviation . . . . .

R.A.F. Commissions

THE following R.A.F. officers have been appointed to short service commissions in the branches shown:—

General Duties Branch

Flight Lieutenants G. P. Barry, H. R. Farmery, K. A. Forster, G. E. H. Hackman, L. Hague, C. A. Hayley, D.F.C., A. R. Hill, D.F.C., A. Jones, D. A. Preston, D. A. Shaw, D.F.C., A.F.C., A. C. Southward, T. B. Watt.

Flying Officers R. W. Bradley, C. R. Corney, F. L. Couzens.

Technical Branch

Squadron Leader G. H. Williams.
Flight Lieutenant G. C. Matthews.
Flying Officer H. J. Granger.

Equipment Branch

Squadron Leaders W. G. Hughes, H. P. Webb.

Flight Lieutenants R. W. Aitken, G. E. Bamford, G. C. P. Dunkason, N. Friend, R. K. Harris, C. Hattrick, F. M. Kendall, J. L. Moore, G. G. Murray, E. F. Nettlefold, A. H. E. Purnell, A. E. Walter.

Flying Officers R. A. Bain, L. R. Benford, R. G. Blackwell, D.F.M., J. E. Currie, T. A. Evans, B.E.M., C. T. J. Kilgannon, J. P. F. Lloyd, G. A. S. Pett, H. E. Pike, C. Prior, W. Regan, C. R. Scott-Jackson, J. A. G. Westwood.

Pilot Officers S. Brydone, W. H. Eden.

Secretarial Branch

Squadron Leaders E. Cornish, H. T. Murly-Gotto.

Flight Lieutenants C. E. Casbolt, D.F.M., S. E. Chandler, L. H. Darby, S. J. Fielding, H. E. Green, W. G. J. Hordley, T. W. Ingham, A. W. King, J. F. L. Long, D. A. R. Moseley, W. Percy, G. F. Rideout, A. Stobie.

Flying Officers E. M. Adamson, H. Adamson, B. J. Allen, J. B. Ball, W. J. Bowman, T. W. P. Clifford, D.F.C., J. W. Cobbold, R. C. Crossman, J. E. Dagnall, J. R. Dawson, J. Derbyshire, J. H. D. Ebanks, D.F.M., R. Gebbels, J. W. Gilvey, F. C. Greenman, S. G. Head, F. W. A. Hendry, D.F.C., J. A. Jamieson, F. R. King, A. C. Kirk, F. S. Lacey, L. J. Logan, H. Owen, S. J. Palmer, D.F.C., R. L. A. Roberts, D.F.M., A. H. Rowden, R. A. L. Simpson, N. J. P. Tull.

Pilot Officers K. Craig, G. P. Thornton-Pett.

Medical Branch

Flight Lieutenant R. A. Armstrong, L.M.S.S.A.

Chaplains Branch

C. of E. Rev. W. G. Reeves, R. C. H. Swain, B.A.

Methodist Rev. S. V. Hollis.

R.A.F. Regiment

Squadron Leader P. R. Little.
Flight Lieutenant T. A. Gogarty.
Flying Officers A. Boothby, N. A. Falconer.

Provost Branch

Wing Commander H. L. Hutchinson.
Flight Lieutenant B. W. Green.
Flying Officer H. C. Darnton, D.F.C.

Physical Fitness Branch

Flying Officer J. L. Petrie.

Aircrafthands Wanted

THE R.A.F. trade of an Aircrafthand, which was closed last year (as more than enough volunteers were coming forward) is now open again. Thirty volunteers are wanted each week and of this number no fewer than fifteen will have the chance of selection each week as drill instructors. The standard of selection will necessarily be high since these instructors will have responsibility for training recruits and handling men on parade. Equally they will all have a chance to change to a more skilled trade if they wish and to sign on for further service with good promotion possibilities after their first few years.

Successes at College

TWO officers of the Technical Branch of the R.A.F., on completion of the two-year post-graduate course at the College of Aeronautics, Cranfield, Beds., have been awarded the College Diploma, with distinction. One has been awarded the Principal's Prize. Both officers—W/C. R. J. Rackham, of the Engineering branch, and S/L. J. H. Hunter-Tod, of the Signals branch, studied aircraft design as their specialist subject in the final year. S/L. Hunter-Tod won the Principal's Prize for the most original piece of work by a second-year student. Their successes were considered noteworthy because their fellow students were mostly graduates engaged in research and development work in the aircraft industry.

The College of Aeronautics was set up by the Government in 1946 to provide post-graduate training in aeronautical subjects to fit students for leadership in the aircraft industry, Civil Aviation, the Services, education and research. Courses last two years; the first year is devoted to a general study of aeronautical subjects, and in the second year students specialize in a particular subject. Practical work in laboratories and wind-tunnels has a conspicuous place in the course and students in both years take part in flight experiments. The R.A.F. was quick to appreciate the potentialities of these post-graduate courses in providing the kind of training required by technical officers to fit them for the new "integrated" branch and in October, 1946, nine officers were entered for the first-year studies.

In October next there will be four R.A.F. students at the College, two in their second year and two in their first.

Mess Dress for W.A.A.F. Officers

AS a form of mess dress for W.A.A.F. officers serving in Home Commands of the Royal Air Force, the King has approved the wearing of service dress with soft white shirt, semi-stiff turned down collar and long black tie on all occasions when evening dress is appropriate and it is necessary or suitable that uniform should be worn.

R.O.C. at Stradishall

LAST Sunday week a Lancaster and a Lincoln of Bomber Command made six flights at widely different heights and speeds over R.A.F. Station, Stradishall, Suffolk. Some 450 members of the Royal Observer Corps, attending a bi-annual Group meeting, and organized in about 40 posts and sections, recorded their estimates of the heights and speeds. The correct figures were received from the pilots by R/T at the control tower, and the R.O.C. post or section with the most accurate estimates received a framed certificate. Vampires, Meteors, and Hornets of Fighter Command obliged with aerobatics and there were static displays of radar and armament.

Reunion

THE third annual Mount Hampden, Southern Rhodesia, reunion dinner will be held at the "Rising Sun," Tottenham Court Rd., London, at 6.30 for 7 p.m., on September 4. Tickets, 10s. 6d each, from C. Nepean Bishop, 34, Cartwright Gardens, W.C.1, before September 1.

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Officers of the three Services who were stationed on the Cocos Islands between March 1st and June 1st, 1945, are invited to communicate with the Organising Secretary, Cocos Islands Reunion, Room 312, Bush House (S.E.), Strand, London, W.C.2, with a view to a reunion in London. They should indicate which Friday in November would be convenient.

CHINESE CELEBRATION: To commemorate their first air victory over the Japanese, the Chinese Air Force hold an annual celebration. This year a reception at the Chinese Embassy marked the occasion. Left to right in the foreground of this group are Colonel Harris (U.S. Marines), Sir Frederick Handley Page, Air Marshal Sir James Robb and Colonel Ling.